**FOR YOUR SAFETY**
***If you smell gas:***
1. **Open windows.**
2. **DO NOT try to light any appliance.**
3. **DO NOT use electrical switches.**
4. **DO NOT use any telephone in your building.**
5. **Leave the building.**
6. **Immediately call your local gas supplier after leaving the building. Follow the gas supplier's instructions.**

## ⚠ WARNING

**Fire Hazard**

**Do not store or use petrol or other flammable vapours and liquids in the vicinity of this or any other appliance.**

**Failure to follow these instructions can result in death, injury or property damage.**

ROBERTS GORDON

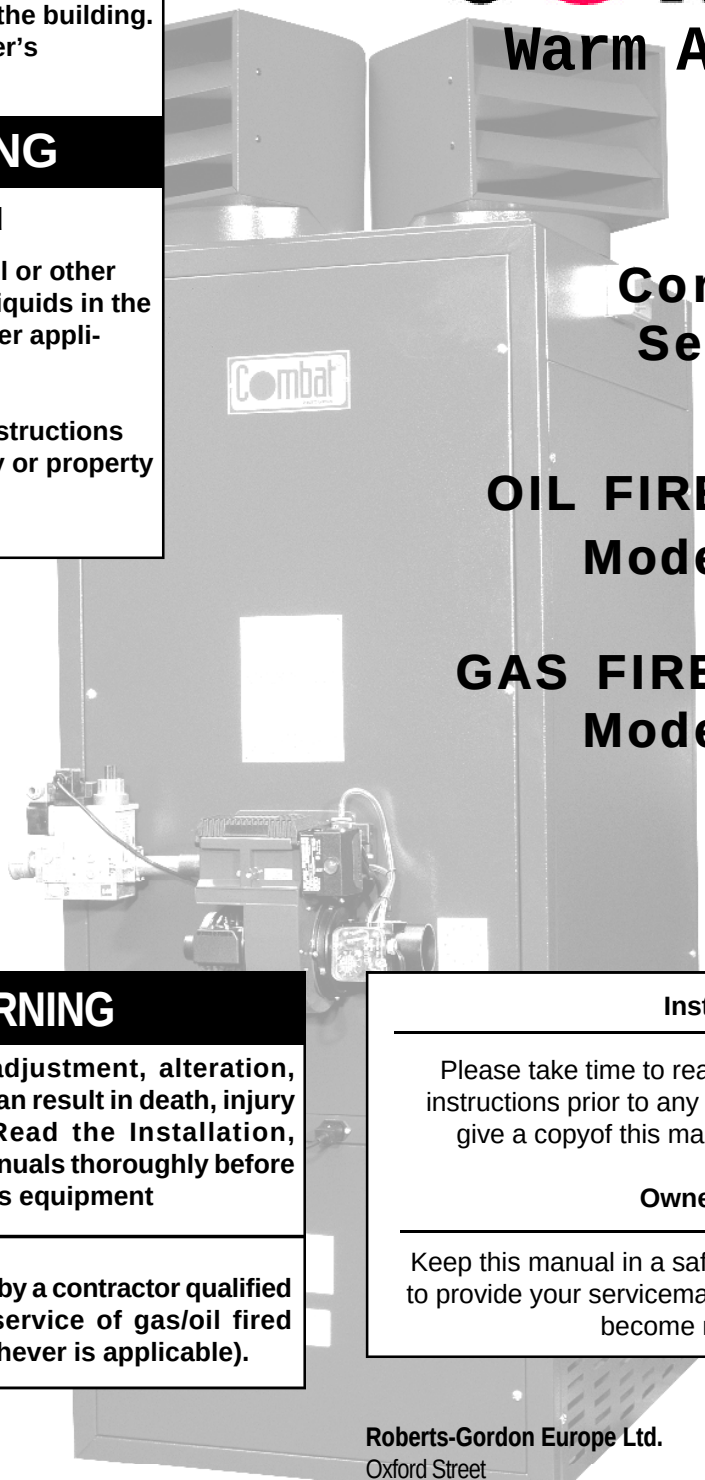
Combat®

# Warm Air Cabinet Heaters

## Installation, Commissioning, Service & User Instructions

## OIL FIRED: POP--ECA Models 15 to 100

## GAS FIRED: PGP--ECA Models 15 to 100




## ⚠ WARNING

**Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the Installation, operation and service manuals thoroughly before installing or servicing this equipment**

**Installation must be done by a contractor qualified in the installation and service of gas/oil fired heating equipment (whichever is applicable).**

**Installer**

Please take time to read and understand these instructions prior to any installation. Installer must give a copyof this manual to the user/owner.

**Owner/User**

Keep this manual in a safe place close to the heater to provide your serviceman with information should it become necessary.

CE

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X523G 08/04

The gas fired versions of these appliances have been tested and certified as complying with the essential requirements of the Gas Appliance Directive, the Electromagnetic Compatibility Directive, The Low Voltage directive and the Machinery Directive for use on natural gas and L.P.G. Propane when installed, commissioned and maintained in accordance with these instructions

The gas fired heaters are category $II_{2H\,3P}$ for natural gas or propane gas and are type $B_{23}$ for a natural draught flue.

These instructions refer to gas appliances designed to operate in the following countries: United kingdom (GB), Ireland (IE), Italy (IT) and Spain (ES)

The oil fired versions may also operate in these countries in accordance with local rules and laws.

The oil fired versions are constructed to the same Basic design criteria to burn fuel oil as specified below but there is no similar testing available for these products at the time of writing these instructions.

However the safe operation of the heaters depends on the proper installation, commissioning and maintenance of the appliances in accordance with these instructions .

**The fuel specified for oil fired burners is:**

Class D fuel oil to BS 2869
Which is similar to Gas oil with a maximum viscosity at 20° C of 1.5° E

These appliances must be installed in accordance with the rules in force, and used only in a sufficiently ventilated space, as specified in these instructions and local regulations.

Before installation, check that the local distribution conditions of the fuel, the quality of the fuel and the appliance adjustment are compatible.

These instructions cover the installation setting and operation of all variations of the COMBAT® range of cabinet heaters. The burner manufacturers instructions are also provided to give detailed instructions on the operation of the burner. The settings for use of the burner with the air heater are shown in these instructions or the relevant supplement which is issued with the appliance to cover specific features available for various options.

It is important that all of the relevant information is used when installing, setting or operating this equipment

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# Contents

The parts of this manual are numbered by section, clause and sub clause. Hence: 1.2.3 refers to Section 1, clause 2, sub clause 3. Figure numbers also follow this notation hence: Fig 2.3 is Section 2, fig.3.


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THIS MANUAL RELATES TO THE AIR HEATERS WHICH ARE MANUFACTURED FOR USE WITH:-

**OIL FIRED HEATERS:**
Class D fuel oil to BS 2869
Which is similar to
Gas oil with a maximum viscosity at 20° C of 1.5° E

**GAS FIRED HEATERS**
Natural gas G20
L.P.G Propane (G31)

**THESE INSTRUCTIONS ARE TO BE LEFT WITH THE USER OR NEAR THE HEATER**

**Note:** Every effort is made to ensure that the information within this manual is accurate.
However, Robert-Gordon reserves the right to alter specifications without prior notice.

Roberts-Gordon shall not be liable to rectify any defects or damage caused by any modifications made or attempted to be made to the heating units by the customer, his servants, agents or employees.

# *Section 1.* General Specification

## 1.1 General Information - Standard Models

COMBAT® cabinet warm air heaters are self contained units fitted with a packaged burner and are supplied ready for installation on site to be used with external controls.
The burner controls which form part of the packaged burner are designed for safe operation between -20°C to 60°C. However the heater should not be operated in ambient temperatures above 32°C .At Ambient temperatures above 29°C some models may require the maximum heat input to be reduced, seek advice from Roberts-Gordon UK Ltd. under these circumstances

The standard PGP---ECA or POP ---ECA heater is the 'free standing' model.

Models are available with various options are:

PGP--ECA-S models for use in the horizontal (suspended) mode
gas fired ranges for Ecoflam high /low burners
gas fired ranges for Ecoflam fully modulating burners
weatherproof models for external siting

PGP---ECA-S models for use in the horizontal (suspended) mode
oil fired ranges are also available with Ecoflam High /Low burners
weatherproof models for external siting

COMBAT® cabinet heaters are available with heat outputs ranging from 47.4kW to 293kW.

All heaters are fitted with fully automatic 'packaged' forced draught oil fired or gas fired burners manufactured for Roberts-Gordon UK Ltd.

The heater cabinets are manufactured in Zintec coated mild steel which is finished with a stove cured powder coat paint.

The combustion chambers are of high grade stainless steel construction. The heat exchangers are mild steel tubular all welded construction.

Centrifugal fan(s) located in the base of the heater cabinet provide heated recirculation air, which is distributed from the top of the heater through the fully adjustable louvred outlet heads.

The **fan(s)** are either direct drive or belt driven dependent upon model:

Models 015 - 050 inclusive - Direct Drive (except High Flow)
Models 060 - 0100 inclusive - Belt Drive

The **required electrical supply** is: 230 volt 50Hz single phase on models 15 to 30 and 400 volt 50Hz three phase and neutral on models 40 to 100 (Models PGP and POP 040 and 050 are also available as single phase belt drive to special order). All High Flow models require a 400V, 50Hz, three phase and Neutral electrical supply.

ON/OFF control, temperature control, time control, and frost protection are available as a remote control which needs to be site wired to afford proper operation of the heater. Alternatively, any remote energy controls may be used which must be installed in accordance with Section 4.3.

Each heater must be fitted with its own natural draught flue in accordance with local regulations and the instructions in this booklet. **Fig. 1.1 shows the basic parts of the heater.**

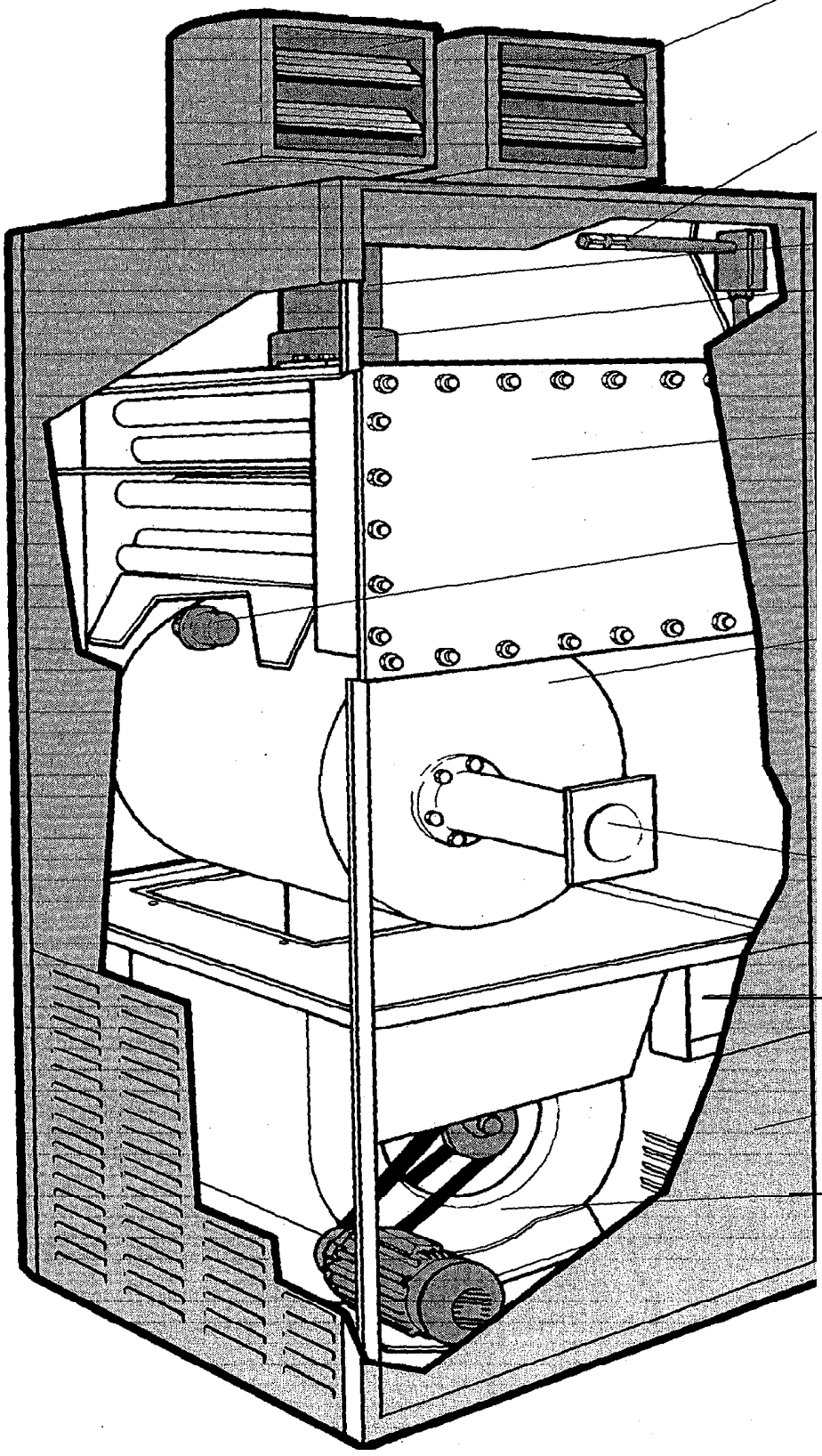

Air Diffuser Heads
Fan/Limit Thermostat
Flue
Flue Spigot (female)
Heat Exchanger
Rear Pressure Relief
Stainless Steel Combustion Chamber
Double Skin Panels
Burner Tube (for mounting the 'packaged' burner)
Electrical Connections
Lower Front Panel
Main Fan Assembly (Direct Drive on Models 15 - 50, Belt Dive on Models 60 -100)

**Fig 1.1 Standard PGP/POP Cabinet Heater - General Arrangement**

## 1.2 Heater Operation (On/Off)

Once the heater has initially been switched on using the remote controls, the operation of the heater becomes automatic under the control of the remote time/temperature controls (as fitted on site) and the safety devices.

When the external controls call for heat, the control box of the fully automatic burner checks that all systems are in a safe and ready position, and then initiates a start sequence. It then constantly monitors safe operation of the burner (see Section 2.2 & 2.3 for details).

When the heat exchanger has been sufficiently heated, the built in fan thermostat turns on the main fan(s) and warm air is distributed from the top of the heater.

***Note:*** On horizontally mounted heaters, High Flow heaters, heaters fitted with high/low or modulating burners and some fully ducted heaters, the fan will come on during the burner firing cycle and not wait for the temperature rise. This is to ensure that there is always a proper operation of the heater under all possible conditions.

At the close down of the external controls, the burner shuts off and the main fan(s) continue to run until the fan thermostat detects a drop in leaving air temperature, sufficient to turn it off. The heater is then at rest until the beginning of the next cycle.

If for any reason the main fan should fail or the air flow through the heater is reduced, then the built in limit thermostat will cause the burner to go to safety shut down 'lockout'. This condition will remain until the fault is corrected and the manual 'red' reset button is operated at the limit thermostat.

### 1.2.1 Heater Operation (High/Low)

For burners which are capable of High/Low operation, a two stage thermostat will be required to be installed on site to alow the burner to operate On/Off and High/Low dependant upon conditions (see 4.3.1.1 for details)

### 1.2.2 Heater Operation (Fully Modulating)

For gas burners only which are capable of Fully Modulating operation the burner comes complete with a temperature control system. The sensor of this system needs to be installed on site (see 4.3.1.2) to allow the burner to vary the heat input to maintain a constant control temperature.

**WARNING**

The main electrical isolator should only be used in an emergency and for servicing.
It should never be used for closing down the burner, as this switches off the main fan prematurely and may damage the heat exchanger, invalidating the warranty and causing a potential fire hazard.

# *Section 2.* Technical Data

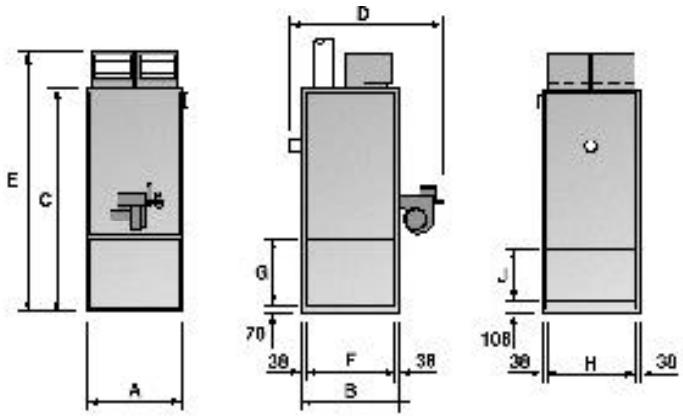
## Table 2.1 General Data All Standard Models PGP and POP and All Versions for High/Low or Modulating Burners

| | Model PGP/ POP - - ECA | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 100 |
|---|---|---|---|---|---|---|---|---|---|---|
| A Width | mm (ins) | 724 (28½) | 724 (28½) | 724 (28½) | 857 (33¾) | 857 (33¾) | 1016 (40) | 1016 (40) | 1016 (40) | 1016 (40) |
| B Depth - Cab.Only | mm (ins) | 857 (33¾) | 857 (33¾) | 857 (33¾) | 857 (33¾) | 1016 (40) | 1676 (66) | 1676 (66) | 1676 (66) | 1994 (78½) |
| C Height - Cab.Only | mm (ins) | 1740 (68½) | 1740 (68½) | 1740 (68½) | 1930 (76) | 1930 (76) | 1930 (76) | 1930 (76) | 1930 (76) | 1930 (76) |
| D Depth Overall Oil | mm (ins) | 1220 (48) | 1220 (48) | 1220 (48) | 1254 (49½) | 1413 (55¾) | 2251 (88¾) | 2251 (88¾) | 2251 (88¾) | 2569 (101¼) |
| D Depth Overall Gas | mm (ins) | 1306 (51½) | 1306 (51½) | 1306 (51½) | 1348 (53) | 1507 (59½) | 2388 (94) | 2388 (94) | 2388 (94) | 2706 (106½) |
| E Height Incl. Heads | mm (ins) | 1988 (78¼) | 1988 (78¼) | 2058 (81) | 2235 (88) | 2235 (88) | 2235 (88) | 2235 (88) | 2235 (88) | 2235 (88) |
| F L/R Hand Air Inlet Spigot Depth | mm (ins) | 781 (30¾) | 781 (30¾) | 781 (30¾) | 781 (30¾) | 940 (37) | 1600 (63) | 1600 (63) | 1600 (63) | 1918 (75½) |
| G L/R Hand Air Inlet Spigot Height | mm (ins) | 457 (18) | 457 (18) | 457 (18) | 559 (22) | 559 (22) | 559 (22) | 559 (22) | 559 (22) | 559 (22) |
| H Rear Air Inlet Spigot Depth | mm (ins) | 648 (25½) | 648 (25½) | 648 (25½) | 781 (30¾) | 781 (30¾) | N/A | N/A | N/A | N/A |
| J Rear Air Inlet Spigot Height | mm (ins) | 361 (14) | 361 (14) | 361 (14) | 446 (17¾) | 446 (17¾) | N/A | N/A | N/A | N/A |
| Weight | kgs (lbs) | 200 (441) | 200 (441) | 200 (441) | 245 (540) | 270 (595) | 440 (970) | 440 (970) | 440 (970) | 530 (1168) |
| Number and size of air discharge heads | mm | 2 x 229 | 2 x 229 | 2 x 356 | 2 x 356 | 2 x 356 | 6 x 356 | 6 x 356 | 6 x 356 | 6 x 356 |
| Flue Diameter | mm (ins) | 178 (7) | 178 (7) | 178 (7) | 178 (7) | 178 (7) | 229 (9) | 229 (9) | 229 (9) | 229 (9) |
| MAIN FAN | | | | | | | | | | |
| Motor Type | | Dir. Drive | Dir. Drive | Dir. Drive | Dir. Drive | Dir. Drive | Belt Drive | Belt Drive | Belt Drive | Belt Drive |
| Motor Size | | 0.75 (1) | 0.75 (1) | 0.75 (1) | 2.2 (3) | 2.2 (3) | 1.5 (2) | 2.2 (3) | 2.2 (3) | 4 (5.4) |
| Motor Pulley | kW (hp) | n/a | n/a | n/a | n/a | n/a | 2A x 80mm | 2A x 95mm | 2A x 95mm | 2A x106mm |
| Fan Pulley | PCD | n/a | n/a | n/a | n/a | n/a | 2Ax180mm | 2Ax180mm | 2Ax180mm | 2A x 180mm |
| Main Fan Start Current | amps | 24 | 24 | 28 | 21 | 21 | 10.2 | 30 | 30 | 35 |
| Main Fan Run Current | amps | 5.3 | 5.3 | 6.3 | 6.2 | 6.2 | 3.5 | 5.1 | 5.1 | 9.6 |
| Airflow (Free Blowing) | M³/hr | 3398 | 3398 | 5097 | 6796 | 8495 | 11044 | 12443 | 12443 | 17330 |
| | ft/hr | 2000 | 2000 | 3000 | 4000 | -5000 | 6500 | 7500 | 7500 | 10200 |
| AC Electrical Supply | | | | | | | | | | |
| Total Elec. Load | kW | 2.1 | 2.1 | 2.1 | 5.4 | 5.4 | 4.4 | 5.5 | 5.5 | 6.6 |
| | Volts | 230 | 230 | 230 | 400 | 400 | 400 | 400 | 400 | 400 |
| | Hertz | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| | Phase | 1 | 1 | 1 | 3N | 3N | 3N | 3N | 3N | 3N |

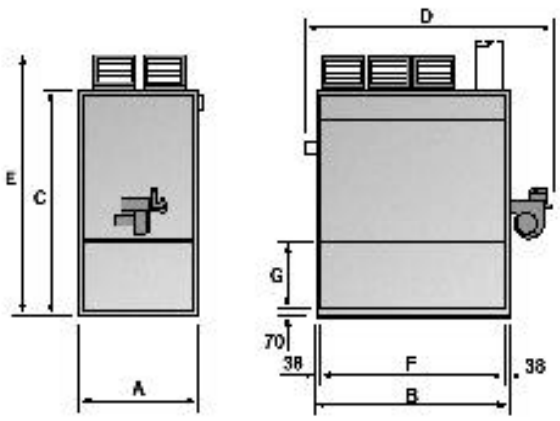
Dimensions for Horizontal heaters are as above, with heaters lain on their left hand side as standard.
***** For vertical models add 54mm (2 ins) to the right hand side of the heater cabinet for the fan/limit thermostat.
***** For horizontal models add 54mm (2 ins) to the top of the heater cabinet for the fan/limit thermostat.

**Note:** A permanent uninterrupted electrical supply is required for all models

## Dimensions - All Models PGP and POP




Cabinet Sizes 015 - 050

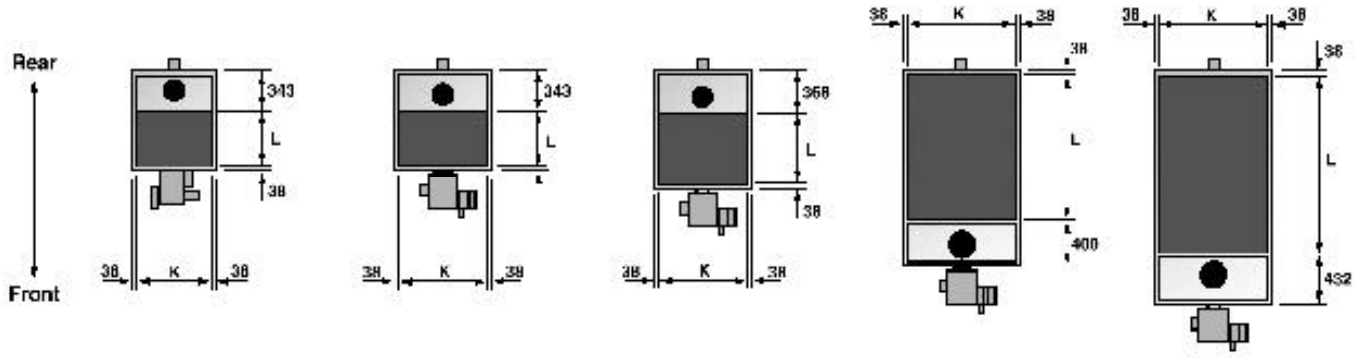



Cabinet Sizes 060 - 0100

Note: Horizontal heater dimensions are as vertical units, but with heaters lain on their left hand side as standard.

## Dimensions of outlet spigots - Standard Cabinet Heaters

**015/020/030** **040** **050** **060/070/080** **0100**




## Air Outlet Spigot Dimensions - Standard Cabinet Heaters

| MODEL | | 015 | 020 | 030 | 040 | 050 | 060/070/080 | 0100 |
|---|---|---|---|---|---|---|---|---|
| K Spigot Width | mm (ins) | 648 (25½) | 648 (25½) | 648 (25½) | 781 (30¾) | 781 (30¾) | 940 (37) | 940 (37) |
| L Spigot Depth | mm (ins) | 476 (18½) | 476 (18½) | 476 (18½) | 476 (18½) | 610 (24) | 1238 (48¾) | 1524 (60) |

**DATA TABLES - IMPORTANT NOTE**

When reading the Data Tables 2.3 to 2.9 on the following pages,
ensure that the correct table for the burner and gas valve installed is being used.

The Data Tables are listed under a burner reference letter which can be found
on the heater data plate.

Refer also to the Burner Manufacturer's Instructions
and the specific instructions supplement where applicable.
The burner settings shown in the instructions should be used for burner settings.

## Table 2.3 Oil Fired Burner Data (Ecoflam Burner)

### Burner Reference "G"

| | Model | POP 015 | POP 020 | POP 030 | POP 040 | POP 050 | POP 060 | POP 070 | POP 080 | POP 0100 |
|---|---|---|---|---|---|---|---|---|---|---|
| Heat Input (gross) | Kw | 55.5 | 73.3 | 93.2 | 129.9 | 162 | 208 | 242 | 275.2 | 348.5 |
| | Btu/hr x 1000 | 189.4 | 250.1 | 318.0 | 443.2 | 552.7 | 709.7 | 825.7 | 939.0 | 1189.082 |
| Nominal Heat output | Kw | 47.4 | 61.2 | 78.4 | 110.2 | 134.5 | 177.7 | 205.3 | 230.4 | 293.4 |
| | Btu/hr | 161.8 | 208.9 | 267.4 | 375.9 | 458.8 | 606.5 | 700.3 | 786.2 | 1001.0 |
| Ecoflam Burner type | | Minor 8 | Minor 8 | Minor 12 | Minor 20 | Minor 20 | Minor 30 | Minor 30 | Minor 30 | Major 30 |
| Nozzle Size | Us gall/hr | 1.00 | 1.50 | 2.25 | 3.00 | 3.50 | 4.00 | 5.00 | 5.50 | 7.00 |
| Angle & Type | | 60S | 60S | 60S | 60S | 60S | 60S | 60S | 60S | 60S |
| Make | | Danfoss | Danfoss | Danfoss | Danfoss | Danfoss | Danfoss | Danfoss | Danfoss | Danfoss |
| Head setting | mm | 8 | 0 | 8 (Fully back) | 8 (Fully back) | 8 (Fully back) | 8 (Fully back) | 8 (Fully back) | 8 (Fully back) | (Fully Forw ard) |
| Air setting | Number | 4.2 | 8.5 | 6.5 | 3 | 4 | 3.7 | 4.5 | 6.2 | 4 |
| Burner fuel pressure | Bar | 14.0 | 9.8 | 5.8 | 7.7 | 8.9 | 10.7 | 9.2 | 8.1 | 10.2 |
| | PSI | 203 | 143 | 84 | 111 | 129 | 155 | 134 | 118 | 148 |
| Fuel consumption | L/hr | 5.2 | 6.8 | 8.7 | 12.1 | 15.1 | 19.4 | 22.5 | 25.6 | 32.4 |
| | imp gall.hr | 1.1 | 1.5 | 1.9 | 2.7 | 3.3 | 4.3 | 5.0 | 5.6 | 7.1 |
| Max. oil pressure to pump inlet | Bar | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 | 0.21 |
| | PSI | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Note: High Flow Heaters are fitted with burners to the same specification as the POP 30, 40 and 50 models for oil firing.

# Table 2.4 Ecoflam ON/OFF Natural Gas (G20) Dungs Valve, Burner Reference C

## Data for all versions on/off operation
## Gas rates corrected to standard conditions 1013.25 mbar 15°C

**INLET PRESSURE 20 mbar (Minimum 17 mbar, Maximum 25 mbar)**

| **MODEL** | | **PGP 15 ECA** | **PGP 20 ECA** | **PGP 30 ECA** | **PGP 40 ECA** | **PGP 50 ECA** | **PGP 60 ECA** | **PGP 70 ECA** | **PGP 80 ECA** | **PGP 100 ECA** |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross heat input | (kW) | 55.5 | 73.3 | 93.2 | 129.9 | 162.0 | 208.0 | 242.0 | 275.2 | 348.5 |
| Net heat Input | (kW) | 50.0 | 66.0 | 84.0 | 117.0 | 146.0 | 187.4 | 218.0 | 248.0 | 314.0 |
| Approx heat output | (kW) | 47.4 | 61.2 | 78.4 | 110.2 | 134.5 | 177.7 | 205.3 | 230.4 | 293.4 |
| Start Gas Orifice | (mm dia.) | | | | 5.0 | 6.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Max Gas Rate | ($Sm^3$/hr) | 5.3 | 7.0 | 8.9 | 12.4 | 15.4 | 19.8 | 23.1 | 26.2 | 33.2 |
| Main Burner Gas Pressure | (mbar) | 4.0 | 2.7 | 4.2 | 4.8 | 7.7 | 5.2 | 7.1 | 12.7 | 10.0 |
| Start Gas Pressure | (mbar) | N/A | N/A | N/A | 1.8 | 2.8 | 0.9 | 1.1 | 1.7 | 3.4 |
| **BURNER TYPE** | | AZUR 60 | BLU 120 | BLU 120 | BLU 170 | BLU 250R | BLU 250 | BLU 250 | BLU 250S | BLU 350 |
| Burner Head | | s | s | s | s | s | s | s | s | s |
| Head Setting | (mm) | 0 | 10 | 11 | 15 | 14 | 24 | 24 | 24 | 21 |
| Air Setting | | 2.6 | 4.2 | 6 | 2.2 | 3.5 | 2.9 | 3.6 | 1.4 | 1.6 |
| Valve Type Main Gas | | MBDLE 405 | MBDLE 405 | MBDLE 405 | MBDLE 407 | MBDLE 410 | MBDLE 410 | MBDLE 410 | MBDLE 410 | MBDLE 412 |
| Valve Type Start Gas | | | | | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 |
| AIR PRESSURE SWITCH SETTING | (mbar) | 1.5 | 1.5 | 4.5 | 4.0 | 6.5 | 5.0 | 6.5 | 7.5 | 7.0 |
| Max flue static pressure | | | | | | | | | | |
| norm. flue static pressure | (mbar) | -0.05 | -0.05 | -0.09 | -0.30 | -0.05 | -0.25 | -0.17 | 0.10 | 0.45 |
| Gas Connection | | 3/4" | 3/4" | 3/4" | 3/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" |

HEAD SETTING - **See Adjustment Of The Firing Head in Ecoflam Instructions**

## Table 2.5 Ecoflam ON/OFF LPG (G31) with Dungs Valve, Burner Reference C

## Data for all versions On/Off operation
## Gas rates corrected to standard conditions 1013.25 mbar 15°C

**INLET PRESSURE 37 mbar (MINIMUM 25 mbar , MAXIMUM 45 mbar)**

| **MODEL** | | **PGP 15 ECA** | **PGP 20 ECA** | **PGP 30 ECA** | **PGP 40 ECA** | **PGP 50 ECA** | **PGP 60 ECA** | **PGP 70 ECA** | **PGP 80 ECA** | **PGP 100 ECA** |
|---|---|---|---|---|---|---|---|---|---|---|
| Gross heat Input | (kW) | 55.5 | 73.3 | 93.2 | 129.9 | 162.0 | 208.0 | 242.0 | 275.2 | 348.5 |
| Net heat Input | (kW) | 50.0 | 66.0 | 84.0 | 117.0 | 146.0 | 187.4 | 218.0 | 248.0 | 314.0 |
| Approx heat output | (kW) | 47.4 | 61.2 | 78.4 | 110.2 | 134.5 | 177.7 | 205.3 | 230.4 | 293.4 |
| Main Gas Orifice | (mm dia.) | 8.5 | 10.0 | 10.0 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | |
| Start Gas Orifice | (mm dia.) | | | | 5.0 | 6.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Max Gas Rate | ($m^3$/hr) | 2.1 | 2.8 | 3.5 | 4.9 | 6.1 | 7.8 | 9.1 | 10.4 | 13.1 |
| | (kg/hr) | 3.9 | 5.1 | 6.5 | 9.1 | 11.3 | 14.5 | 16.9 | 19.2 | 24.3 |
| | Lt/hr | 7.7 | 10.1 | 12.9 | 17.9 | 22.3 | 28.7 | 33.4 | 37.9 | 48.1 |
| Main Burner Gas Pressure | (mbar) | 4.2 | 3.3 | 4.6 | 4.8 | 7.5 | 5.8 | 7.8 | 12.0 | 7.6 |
| Start Gas Pressure | (mbar) | | | | 1.6 | 2.5 | 0.8 | 1.0 | 1.5 | 3.1 |
| **BURNER TYPE** | | AZUR 60 AH | BLU 120 AH | BLU 120 AH | BLU 170 AH | BLU 250R AH | BLU 250 AH | BLU 250 AH | BLU 250S AH | BLU 350 AH |
| Burner Head | | s | s | s | s | s | s | s | s | LPG |
| Head Setting | (mm) | | 10.0 | 13.0 | 15.0 | 14 | 24.0 | 24.0 | 24.0 | 20.0 |
| Air Setting | number | 3.0 | 4.8 | 6.6 | 2.6 | 4.5 | 3.1 | 4.2 | 1.6 | 1.8 |
| Valve Type Main Gas | | MBDLE 405 | MBDLE 405 | MBDLE 405 | MBDLE 407 | MBDLE 410 | MBDLE 410 | MBDLE 410 | MBDLE 410 | MBDLE 412 |
| Valve Type Start Gas | | | | | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 | S 0 832 051 |
| AIR PRESSURE SWITCH SETTING | (mbar) | 1.5 | 1.5 | 4.5 | 4.0 | 6.5 | 5.0 | 6.5 | 7.5 | 7.0 |
| Max flue static pressure | | | | | | | | | | |
| norm. flue static pressure | (mbar) | -0.05 | -0.05 | -0.09 | -0.30 | -0.05 | -0.25 | -0.17 | 0.10 | 0.45 |
| Gas Connection | | 3/4" | 3/4" | 3/4" | 3/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" |

HEAD SETTING - **See Adjustment Of The Firing Head in Ecoflam Instructions**

## Table 2.6 Ecoflam HIGH/LOW or MODULATING Burner with Dungs Valve, Burner Reference "H" Natural Gas G20

### Data for all versions
### Gas rates corrected to standard conditions 1013.25 mbar 15°C

**INLET PRESSURE 20 mbar (minimum 17mbar maximum 25mbar)**

| MODEL | | PGP 15 ECA | PGP 20 ECA | PGP 30 ECA | PGP 40 ECA | PGP 50 ECA | PGP 60 ECA | PGP 70 ECA | PGP 80 ECA | PGP 100 ECA |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum Gross heat Input | (kW) | 55.5 | 73.3 | 93.2 | 129.9 | 162.0 | 208.0 | 242.0 | 275.2 | 348.5 |
| Maximum Net heat Input | (kW) | 50.0 | 66.0 | 84.0 | 117.0 | 146.0 | 187.4 | 218.0 | 248.0 | 314.0 |
| Minimum Gross heat Input | (kW) | 38.9 | 51.3 | 65.2 | 90.9 | 113.4 | 145.6 | 169.4 | 192.6 | 244.0 |
| Minimum net heat Input | (kW) | 35.0 | 46.2 | 58.8 | 81.9 | 102.2 | 131.2 | 152.6 | 173.6 | 219.8 |
| Approx Max heat output | (kW) | 47.4 | 61.2 | 78.4 | 110.2 | 134.5 | 177.7 | 205.3 | 230.4 | 293.4 |
| Start Gas Orifice | (mm dia.) | | | | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Max Gas Rate | ($Sm^3$/hr) | 5.3 | 7.0 | 8.9 | 12.4 | 15.4 | 19.8 | 23.1 | 26.2 | 33.2 |
| Min Gas Rate | ($Sm^3$/hr) | 3.8 | 5.0 | 6.3 | 8.8 | 11.0 | 14.2 | 16.5 | 18.7 | 23.7 |
| Main Burner Gas Pressure | (mbar) | 4.9 | 2.4 | 3.3 | 4.1 | 6.7 | 5.2 | 6.7 | 8.0 | 8.6 |
| Min. Burner Gas Pressure | (mbar) | 3.2 | 2.8 | 2.4 | 2.3 | 3.7 | 2.5 | 3.4 | 4.3 | 5.4 |
| Start Gas Pressure | (mbar) | | | | 1.1 | 1.8 | 0.6 | 0.7 | 0.9 | 1.0 |
| **BURNER TYPE** | | AZUR 60 | BLU 120 | BLU 120 | BLU 170 | BLU 250R | BLU 250 | BLU 250 | BLU 250 | BLU 350 |
| Burner Head | | s | s | s | s | s | s | s | s | s |
| Burner Injector | | | | | | | | | | |
| Head Setting | (mm) | 0.0 | 8.0 | 10.0 | 15.0 | 14 | T.O. | T.O. | T.O. | T.O. |
| Low Flame Air Orange Cam | ** | 20° | 13° | 22° | 18° | 18° | 18° | 22° | 25° | 25° |
| High Flame Air Red Cam | ** | 33° | 40° | 80° | 30° | 32° | 30° | 35° | 55° | 60° |
| Gas Valve Setting | | 0-1,5 | 0-1 | 0-1,4 | 0-1,4 | 0-1,4 | 0-1,4 | 0-1,4 | 0-1,4 | 0-1,4 |
| Valve Type Main Gas | | MBVEF 407 | MBVEF 407 | MBVEF 407 | MBVEF 407 | MBVEF 412 | MBVEF 412 | MBVEF 412 | MBVEF 412 | MBVEF 412 |
| Valve Type Start Gas | | | | | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 |
| AIR PRESSURE SWITCH SETTING | (mbar) | 1.5 | 1.5 | 1.5 | 1.0 | 1.5 | 1.5 | 1.5 | 2.0 | 2.5 |
| Max flue static pressure | | | | | | | | | | |
| norm. flue static pressure | (mbar) | -0.05 | -0.05 | -0.09 | -0.30 | -0.05 | -0.25 | -0.17 | 0.10 | 0.45 |
| Gas Connection | | 3/4" | 3/4" | 3/4" | 3/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" | 1 1/4" |

S.= STANDARD

** Note the air setting is a guide only, the final setting is subject to the combustion testing.

HEAD SETTING **- See Adjustment Of The Firing Head in Ecoflam Instructions**

When setting the minimum firing rate a check must be made following the setting of the burner combustion .
The check is made by running the heater on low fire for a minimum of 15 minutes at the full transport air rate and at typical ambient conditions. During the test check that the flue gas temperature does not fall below 150°C .Should the flue gas temperature fall below 150°C then the low fire gas setting must be increased to a value that will achieve 150°C flue gas temperature, otherwise condensation may form in the heat exchanger and flue causing rapid corrosion and short operational life.

# Table 2.7 Ecoflam HIGH/LOW or MODULATING Burner with Dungs Valve Burner Reference "H" L.P.G. G31

## Data for all versions
## Gas rates corrected to standard conditions 1013.25 mbar 15°C

**INLET PRESSURE 37 mbar (minimum 25mbar, maximum 45mbar)**

| MODEL | | PGP 15 ECA | PGP 20 ECA | PGP 30 ECA | PGP 40 ECA | PGP 50 ECA | PGP 60 ECA | PGP 70 ECA | PGP 80 ECA | PGP 100 ECA |
|---|---|---|---|---|---|---|---|---|---|---|
| Maximum Gross heat Input | (kW) | 55.5 | 73.3 | 93.2 | 129.9 | 162.0 | 208.0 | 242.0 | 275.2 | 348.5 |
| Maximum Net heat Input | (kW) | 50.0 | 66.0 | 84.0 | 117.0 | 146.0 | 187.4 | 218.0 | 248.0 | 314.0 |
| Minimum Gross heat Input | (kW) | 38.9 | 51.3 | 65.2 | 90.9 | 113.4 | 145.6 | 169.4 | 192.6 | 244.0 |
| Minimum net heat Input | (kW) | 35.0 | 46.2 | 58.8 | 81.9 | 102.2 | 131.2 | 152.6 | 173.6 | 219.8 |
| Approx heat output (Net) | (kW) | 47.4 | 61.2 | 78.4 | 110.2 | 134.5 | 177.7 | 205.3 | 230.4 | 293.4 |
| Main Gas Orifice | (mm dia.) | 8.5 | 10.0 | 10.0 | 14.5 | 14.5 | 14.5 | 14.5 | 14.5 | N/A |
| Start Gas Orifice | (mm dia.) | | | | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 | 7.0 |
| Max Gas Rate | (Sm3/hr) | 2.09 | 2.76 | 3.51 | 4.89 | 6.10 | 7.83 | 9.11 | 10.36 | 13.12 |
| | Kg/h | 3.87 | 5.11 | 6.49 | 9.05 | 11.29 | 14.49 | 16.86 | 19.18 | 24.29 |
| | Ltr/h | 7.65 | 10.11 | 12.85 | 17.91 | 22.34 | 28.68 | 33.37 | 37.94 | 48.05 |
| Min Gas Rate | (Sm3/hr) | 1.46 | 1.93 | 2.46 | 3.42 | 4.27 | 5.48 | 6.38 | 7.25 | 9.18 |
| | Kg/h | 2.71 | 3.58 | 4.55 | 6.34 | 7.90 | 10.15 | 11.80 | 13.42 | 17.00 |
| | Ltr/h | 5.36 | 7.07 | 9.00 | 12.54 | 15.64 | 20.08 | 23.36 | 26.56 | 33.64 |
| Main Burner Gas Pressure | (mbar) | 4.3 | 5.7 | 4.7 | 3.1 | 5.9 | 5.3 | 7.2 | 9.0 | 6.4 |
| Min. Burner Gas Pressure | (mbar) | 2.3 | 2.9 | 1.4 | 1.6 | 2.0 | 2.3 | 2.5 | 3.2 | 2.0 |
| Start Gas Pressure | (mbar) | | | | 1.1 | 1.7 | 0.6 | 0.7 | 0.7 | 1.5 |
| **BURNER TYPE** | | AZUR 60 | BLU 120 | BLU 120 | BLU 170 | BLU 250R | BLU 250 | BLU 250 | BLU 250 | BLU 350 |
| Burner Head | | s | s | s | s | s | s | s | s | s |
| Burner Injector | | | | | | | | | | LPG |
| Head Setting | (mm) | 0.0 | 8.0 | 10.0 | 15.0 | 14 | T.O. | T.O. | T.O. | T.O. |
| Low Flame Air Orange Cam | ** | 20° | 13° | 22° | 18° | 18° | 18° | 22° | 25° | 25° |
| High Flame Air Red Cam | ** | 33° | 40° | 80° | 30° | 32° | 30° | 35° | 55° | 60° |
| Gas Valve Setting | | 0-1,4 | 0,3-0,9 | 0-1,1 | 0-1,1 | 0-1,1 | 0-1,4 | 0-1,4 | 0-1,5 | 0-0,85 |
| Valve Type<br>Main Gas | | MBVEF 407 | MBVEF 407 | MBVEF 407 | MBVEF 407 | MBVEF 412 | MBVEF 412 | MBVEF 412 | MBVEF 412 | MBVEF 412 |
| Valve Type<br>Start Gas | | | | | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 | S.I.T. 832051 |
| AIR PRESSURE SWITCH SETTING | (mbar) | 1.5 | 1.5 | 1.5 | 1.0 | 1.5 | 1.5 | 1.5 | 2.0 | 2.5 |
| Max flue static pressure | | | | | | | | | | |

HEAD SETTING - **See Adjustment Of The Firing Head in Ecoflam Instructions**

When setting the minimum firing rate a check must be made following the setting of the burner combustion .
The check is made by running the heater on low fire for a minimum of 15 minutes at the full transport air rate and at typical ambient conditions. During the test check that the flue gas temperature does not fall below 150°C .Should the flue gas temperature fall below 150°C then the low fire gas setting must be increased to a value that will achieve 150°C flue gas temperature, otherwise condensation may form in the heat exchanger and flue causing rapid corrosion and short operational life.

## 2.2 Control Box - Oil Fired Heaters

*High /Low oil burners although following the general sequence as described below also have extra functional stages related to air damper positions. Refer to burner manufacturers instructions for further detail.*

(See also the Burner Manufacturer's Instructions)

### 2.2.1

The oil fired burner fitted to the heater is controlled by a fully automatic control box and photoelectric flame monitor unit. This control ensures the safe start, ignition and stop sequence and also monitors the safe presence of a flame.

If the flame should fail, or fail to be monitored, then the control will go to the safety shut down "lockout" condition. The button on the front of the control box will light to indicate this. This button will then need to be pressed in manually to reset the control box to recommence the burner firing cycle.

This is a thermal control which, following a lockout condition, cannot be reset until the thermal element has cooled. This takes approximately one minute.

### 2.2.2 Operating Sequence

The operating sequence of the oil fired control boxes are as shown in Figure 2.1.

**WARNING:**
**The control should not be reset from lockout more than three times without identifying and correcting the cause. Residual fuel oil in a combustion chamber is an explosion risk.**

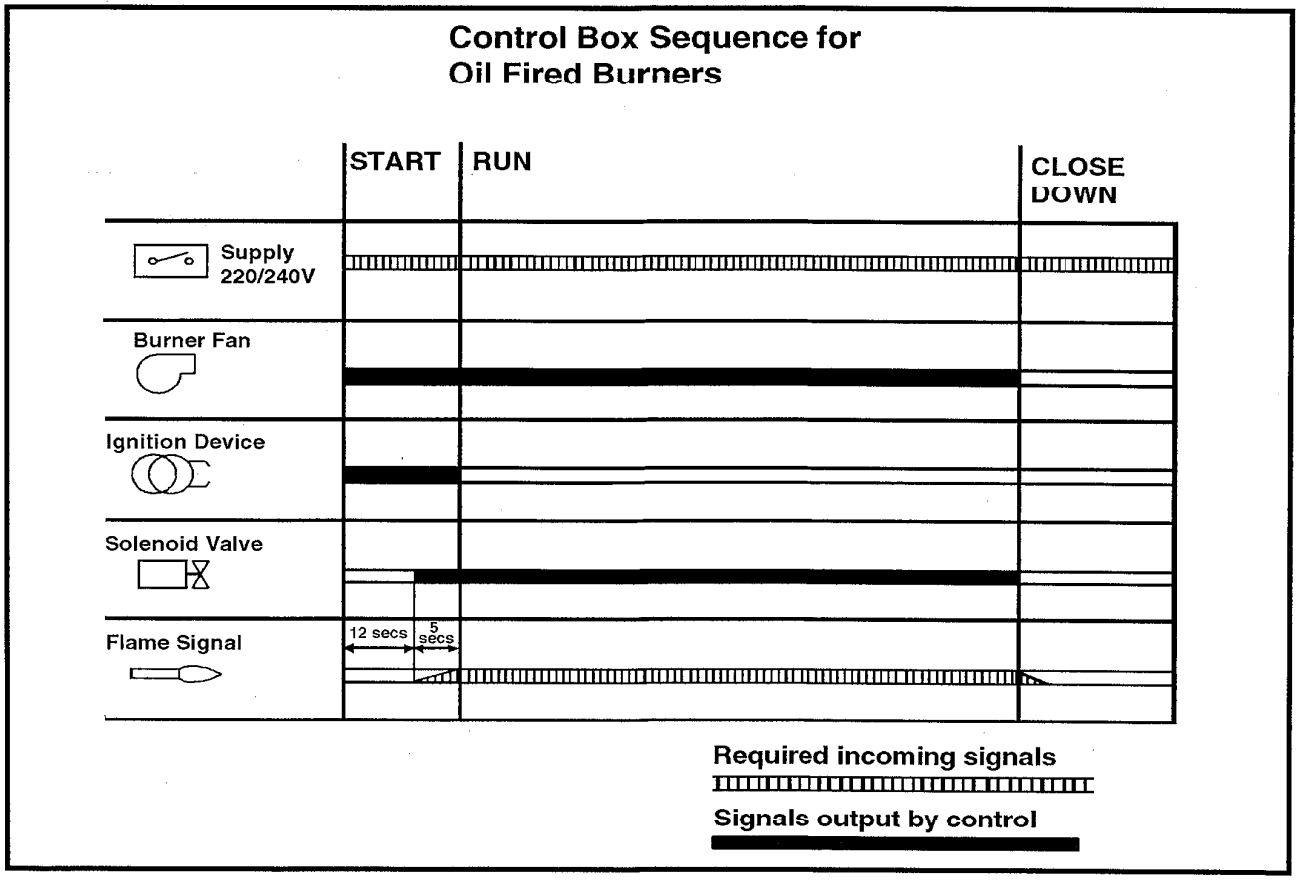



**Fig. 2.1 Oil Fired Control Box Sequence**

### 2.2.3 Sequence of Events

The operating sequence is as follows:

With the external controls on and calling for heat, the burner fan and electric ignition will switch on.

After a combustion air purge of approximately 12 seconds, the oil solenoid valve will open and the burner will fire.

After another 5 seconds the electric ignition is turned off and the burner will go to its normal run position.

The photo cell monitors the safe presence of the flame continuously.

When the temperature control is satisfied, the control box will turn off all its outputs simultaneously, and returns to the rest position for the beginning of the next sequence.

### 2.2.4 Fault Conditions

If at any stage during normal running the photo electric cell fails to detect the flame, the control will switch off and make an instant restart attempt. If the flame signal is still missing “lockout” will occur.

If the flame is not detected by the photo cell during a normal start, there will be no restart attempt and “lockout” will occur in approximately 17 seconds after the start.

If a flame is detected during the first 12 seconds (purge) the solenoid valve will not open and the control will “lockout”. For control sequence see Fig. 2.1.

## 2.3 Control Box - Gas Fired Heaters

(See also the Burner Manufacturer's Instructions)

*High /Low and Modulating burners although following the general sequence as described below also have extra functional stages related to air damper positions. Refer to burner manufacturers instructions for further detail.*

***Ecoflam*** *gas burner have only* ***one*** *pressure switch which is configured to cover both available combustion air and reaction to increases in combustion chamber pressure.*

### 2.3.1 Description of Gas Fired Heater Control Box

The gas fired burner fitted to all COMBAT® cabinet heaters is controlled by a full sequence plug-in control box. This control ensures the safe start and stop sequence and also monitors the safe presence of a flame and burner air pressure.

The Models 15 to 30 are wired for direct ignition of the main flame. All other models are wired for ignition of a start gas flame as first stage and then the main gas flame as the second stage.

### 2.3.2 Sequence of Events

**The operating sequence is as follows:**

With the external controls on and calling for heat, and the air pressure switch at rest, (contacts n.c. closed), the burner fan will switch on after a short wait for the control to "self check."

***Note:*** If the air pressure switch contacts (n.c.) are open there will be no start.

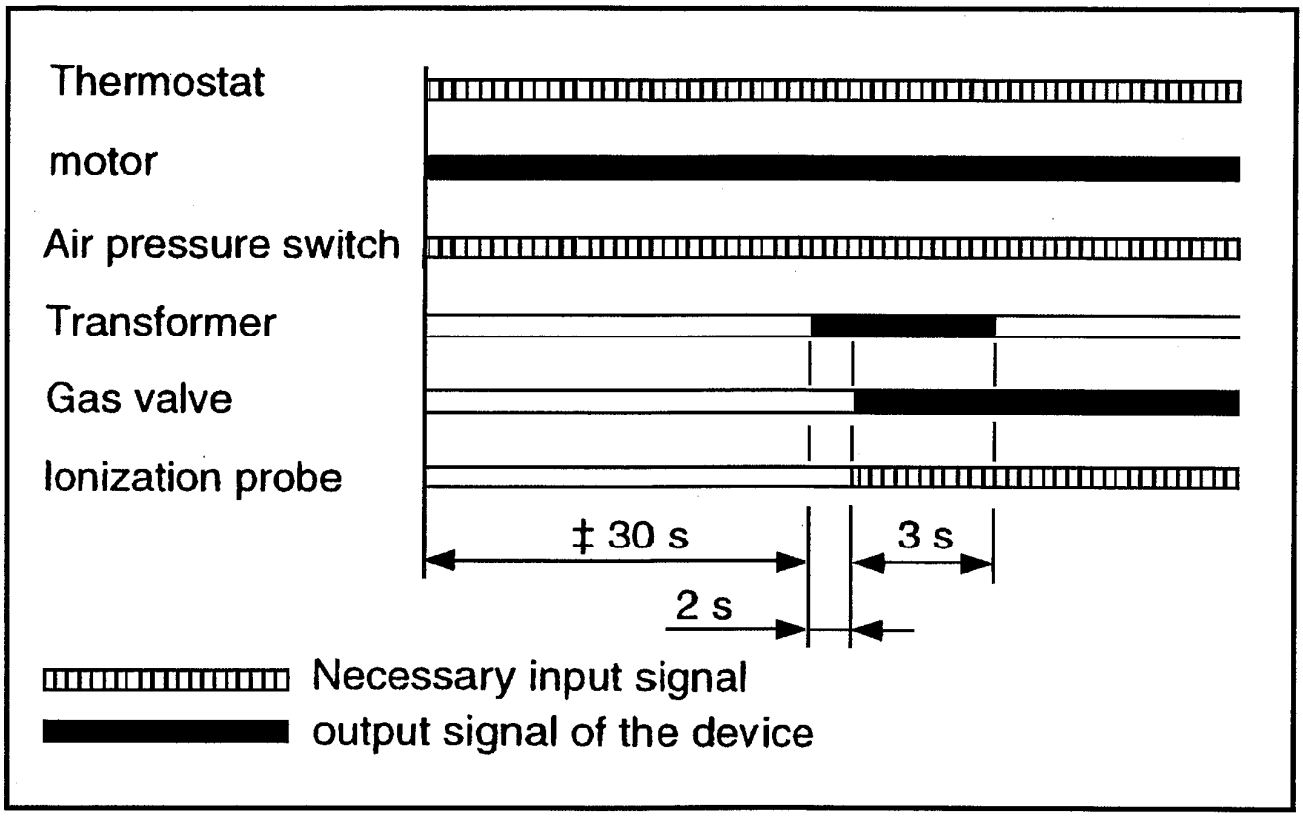



**Fig 2.2 Gas Fired Heater Control Box Sequence**

### 2.3.3 Air Pressure Switch Contacts

The combustion air fan now turns on and the air pressure switch contacts (n.o.) have to close within the next 5 seconds to indicate the availability of sufficient combustion air or lockout will occur.

### 2.3.4 Purge

The sequence continues with a purge time with the burner fan only running.

### 2.3.5 Electric Ignition ON

The electric ignition switches ON at the end of this purge time.

### 2.3.6 Start Gas Valve (Main gas for models 15 to 30)

The start gas valve opens and once a flame has been established this remains on until close down. The flame probe is now continuously monitoring for the safe presence of flame.

### 2.3.7 Electric Ignition OFF

Five seconds later the electric ignition turns off, leaving the start gas flame to be proved as stable.

### 2.3.8 Main Gas Valve (For models above 30)

Ten seconds from when the start gas is energised the main gas valves energise and the main flame expands from the start gas. The control is now in its normal run position.

When the external controls are satisfied the control box turns off all outputs simultaneously and returns to rest position for the beginning of the next sequence.

### 2.3.9 Fault Conditions

If at any stage the flame fails , the air pressure switch detects a loss of air pressure or a rise in combustion chamber pressure ,then the control will go to 'lockout'. The red light on the control box will glow and the control will need to be manually reset before any further start attempt can be made.

For control sequence see Fig. 2.2.

## 2.4 Honeywell Combination Fan/Limit Thermostat

This is a dual function control and safety device:

**1. Fan Thermostat.** This automatically turns the fan ON and OFF during the heater operation controlled by the leaving air temperature. It is fitted with a white manual override button which must be in its "pulled out" position for automatic operation. In its "pushed in" position the fan(s) will run continuously.

**2. Limit Thermostat.** This protects the heater from overheating caused by a reduction of air flow over the heat exchanger. It is a manual reset device and once operated prevents the heater restarting until reset.

To reset wait until the heater has cooled sufficiently then press in and release the red reset button. After operation of the limit thermostat, efforts should be made to locate the problem causing its operation.

**Note**: IT IS ESSENTIAL THAT THE LINK SHOWN IN FIG. 2.3 IS REMOVED IN THE EVENT OF A REPLACEMENT COMBINATION FAN/LIMIT THERMOSTAT BEING FITTED

Following replacement or adjustment, the limit thermostat setting must be re-sealed using a suitable paint spot seal.

For settings see Commissioning Section 5.1.2.1.

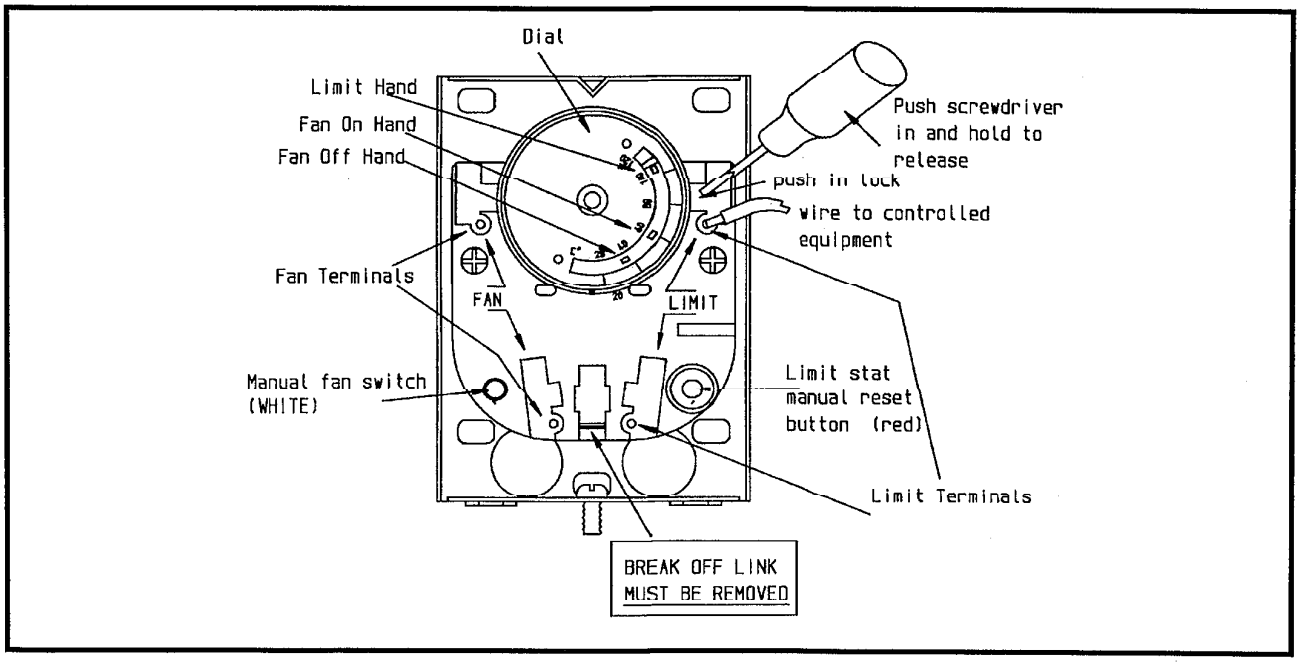



**Fig. 2.3 Combination Fan/Limit Thermostat**

## 2.5 Motor Starter and Thermal Overload

On belt driven fan models the motor is controlled by a direct on line contactor starter fitted with thermal overload protection. If the thermal overload should operate the main fan will not run. To reset, press in the reset button on the overload unit (see Fig. 2.4). Note: For models fitted with a 5.5kW motor or larger, then the direct on line starter will be replaced by an automatic start delta starter - see Fig. 6.14).

The overload should be set to indicate approximately 0.2 amps above the normal running current of the heater (see Table 2.1 Technical Data).

Single phase direct drive fans are controlled directly by the fan thermostat and three phase direct drive fans are controlled by a direct on line contactor starter, but using the motors built in thermal overload protection to operate the contactor coil. On direct drive fan models the thermal overload is built into the motor and is an automatic reset device, connected as shown in the Wiring Diagrams, Section 6.

## 2.6 Burners

For details of the Packaged Burners see the Manufacturer's Instructions and the Data Tables in Section 2.1.
When reading the Data Tables ensure that the correct table for the burner and gas valve installed is being used. The Data Tables are listed under a burner reference letter which can be found on the heater data plate.

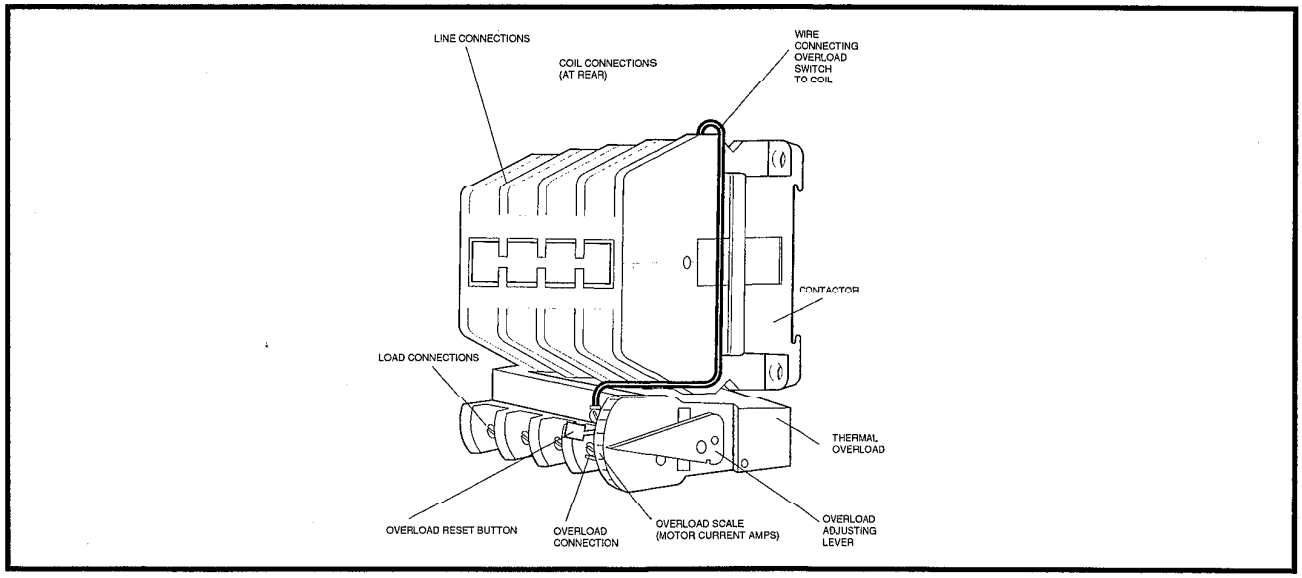



**Fig. 2.4 Motor Starter (Models 40 - 100) and Thermal Overload (Models60- 100 only)**

## 2.7 Gas Valves Used with All Burners

### 2.7.1 Dungs Combination Gas Valves

The Combination Valve features as shown in Fig. 2.6.

All model 15 to 30 gas fired burners operate as direct main flame ignition and have no separate start gas train. All other models operate with a first stage start gas flame supplied from a start gas train containing a start gas pressure regulator and two safety shut off valves, for all gas types.

The main gas is released at the second stage and the combination main gas valve block contains a main burner pressure regulator and two safety shut off valves, for all gas types.

For Ecoflam **High/Low** or **Modulating** burners then the Dungs gas valve has extra features as it is an air/gas ratio control valve.Please refer to the manufacturers instructions regarding the setting of these controls.

The design of the gas train circuits is shown in Fig 2.5.

**Orifice Plate**
Most models require the fitting of a restrictor (orifice) plate between the main gas valve outlet and the burner to prevent the burner from being over fired and provide suitable operating conditions for the gas valves.

**Orifice Plate Position**
**Ecoflam Burner**
For all models this will be fitted into the special union between the main valve and the burner at the point where the gas supply enters the heater.

### 2.7.1.1 Start Gas Valves

For models PGP015 to PGP030 there is no start gas valve fitted.

For all other models the start gas train is fitted with a pressure regulator and two start gas safety shut off valves.

The start gas regulator is used to adjust the burner firing rate during the start gas phase of these models.

### 2.7.1.2 Main Gas Valves

Figure 2.6 shows the position of the burner pressure regulation adjustment. This must be used to set the burner pressure as in the Data Tables as described in Section 5.
*Note: For Ecoflam **High/Low** or **Modulating** burners then the Dungs gas valve has extra features as it is an air/gas ratio control valve.Please refer to the manufacturers instructions regarding the setting of these controls.*

### 2.7.1.3 Throughput Adjuster

Fig 2.6 shows that these types of valve have a throughput adjuster fitted to the second main gas valve.

This will be factory set at fully open on new appliances and will need no further adjustment.

When replacing a gas valve ensure that this device is set in the fully open position by releasing the locking screw and turning the 'V MAX" fully counter clockwise towards the " + " sign and then re-tightening the locking screw.

### 2.7.1.4 Rate of Opening

Fig. 2.6 also shows a slow opening adjustment. This device is a hydraulic damper which slows down the rate of opening of the second main gas valve to give a smooth main gas ignition.

This is preset at the factory at the slowest setting and will need no further adjustment.

If a new valve is fitted than remove the plastic screw-on cap and with a small screw driver turn the "V start" screw fully clockwise towards the " - " sign. Refit the plastic cover.

# *Section 3.* Installation Requirements

## 3.1 Required Standards

It is important that all appliances are installed by competent persons, in accordance with the relevant requirements of all the relevant rules and laws in force.

Gas heaters must be installed by a suitably qualified installer. Failure to install appliances correctly could lead to prosecution. It is in your own interest and that of safety to ensure that the law is complied with.

**The main relevant regulations for installation within the UK are:**

GAS SAFETY (INSTALLATIONS & USE) REGULATIONS 1984 AND IT'S AMENDMENTS - 1996.

**BS6230** - SPECIFICATION FOR THE INSTALLATION OF GAS FIRED FORCED CONVECTION AIR HEATERS FOR COMMERCIAL AND INDUSTRIAL SPACE HEATING OF RATED INPUT EXCEEDING 60Kw.

Note: Although written for gas fired heaters the requirements of this standard should be observed for oil fired heaters, except for the fuel supply.

**BS5588** - PARTS 2 & 3 FIRE PRECAUTIONS IN THE DESIGN & CONSTRUCTION OF BUILDINGS

**BS6891** - LOW PRESSURE INSTALLATION PIPES

**BS5410** - CODES OF PRACTICE FOR OIL FIRING. PART 2 INSTALLATIONS OF 44Kw AND ABOVE OUTPUT CAPACITY FOR SPACE HEATERS, HOT WATER AND STEAM SUPPLY PURPOSES

INSTITUTE OF GAS ENGINEERS DOCUMENT IGE/UP/2

THE BUILDING REGULATIONS

THE IEE REGULATIONS

THE HEALTH & SAFETY AT WORK etc. ACTS

THE REQUIREMENTS OF LOCAL AUTHORITY, FIRE OFFICER AND INSURANCE COMPANY

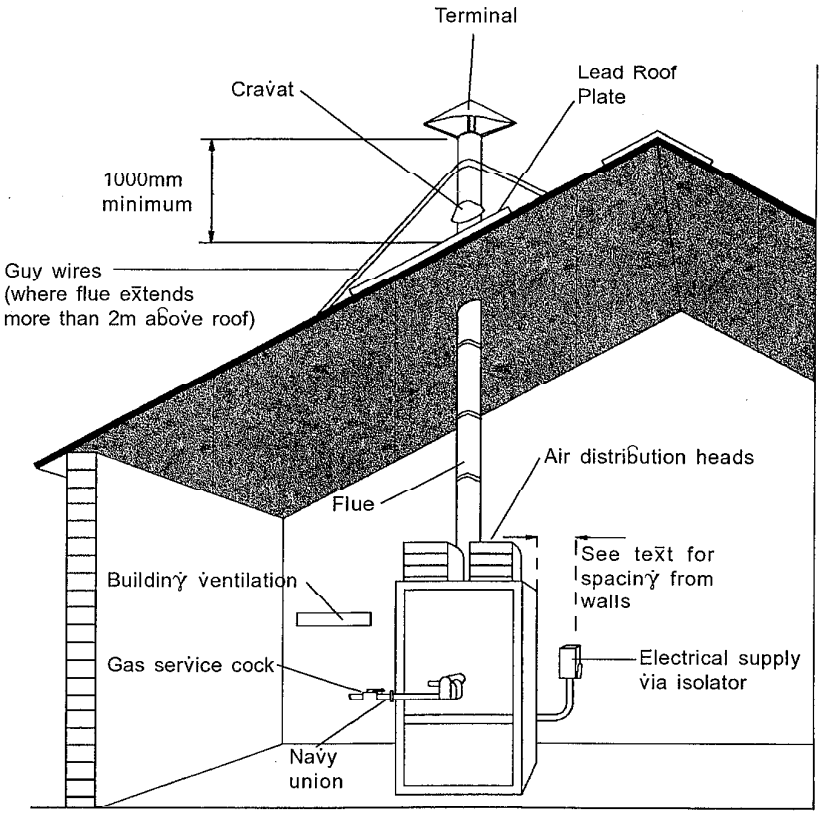
The installation will be similar to that shown on Fig. 3.1.

**WARNING**

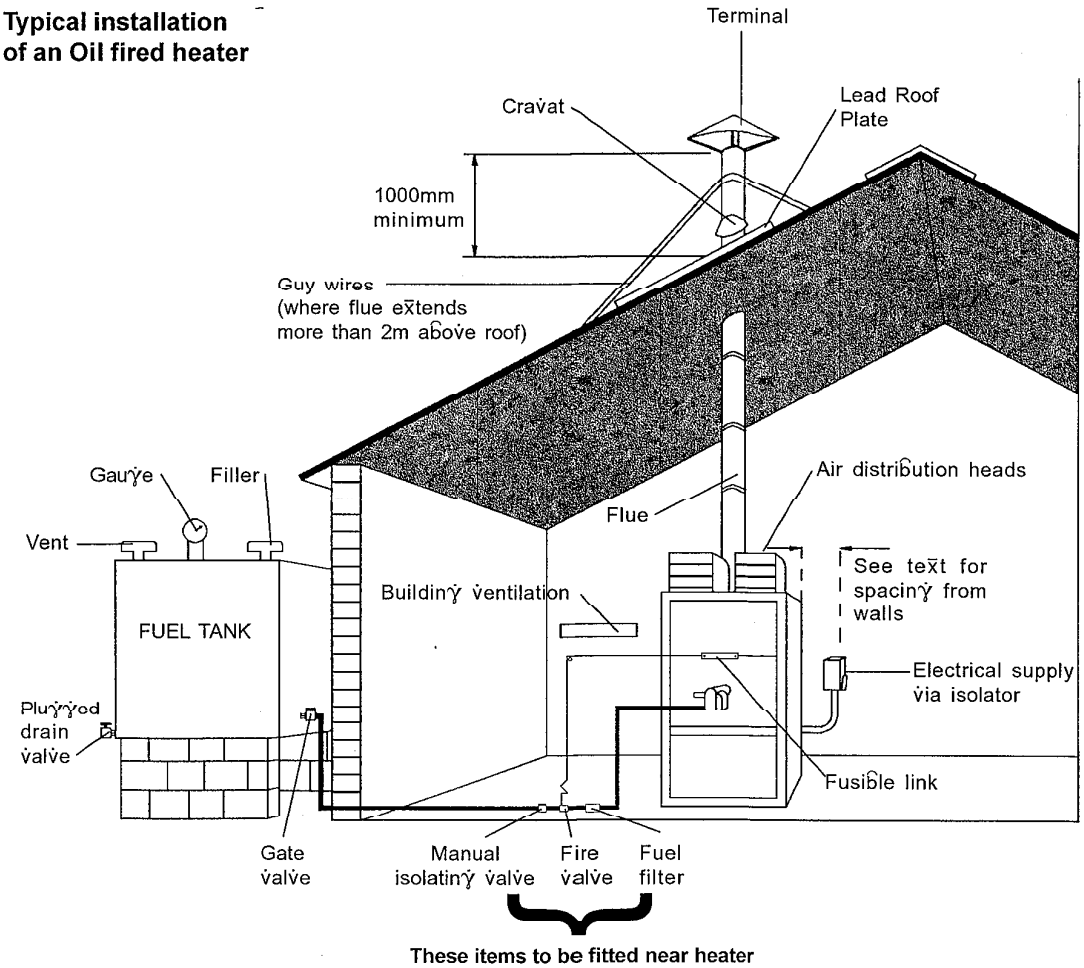
**HEATERS SHOULD NOT BE INSTALLED IN A CORROSIVE OR SOLVENT ATMOSPHERE (I.E. NEAR PLATING OR DEGREASING PLANT), IN AREAS WHERE THERE IS A FIRE RISK, OR ANY OTHER ENVIRONMENT WHICH IS DETRIMENTAL TO THE HEATER OR IT'S OPERATION.**

***CONSULT BS 6230 FOR FURTHER INFORMATION ON HAZARDOUS AREAS***

**Typical installation of a Gas fired heater**




**Typical installation of an Oil fired heater**




## Fig 3.1 Typical Installations

## 3.2 Location of the Heater

The COMBAT® cabinet heater range is designed to be installed floor standing in the **vertical mode**.

Special versions which are supplied with steel channels to support the heater, are available to be mounted in the **horizontal mode**.

**All Models:** All heaters are designed to be installed within the heated area but may be sited in a separate room with the heated air carried by properly designed ductwork supplied by the installer. If used in this remote mode the room and frost thermostats must be within the heated space, and connected as described in Section 4.3 and the return air should be ducted direct to the heater return air spigots.

**Note**: For clarity the clearances and references to cabinet panels refer to the heater installed in the floor standing vertical mode.

**Horizontal Models:** When installed in the horizontal mode the heater will normally lie on its left hand side when viewed from the burner. The same clearances and comments on panels must be assumed for the heater installed in this mode except for the side the heater lies on. The heater should be placed on a firm level surface that can adequately support its weight (See Table 2.1 for weight details) and is of non combustible material.

When siting heaters other than at floor level consideration must be given to providing safe access for engineers to carry out commissioning, routine servicing and repair functions.
Such access must comply with local safety regulations.

### 3.2.1 Clearances

There must be a clear area of at least 0.6 m from each side and to the rear of the heater and not less than 2 m at the front. For all models except High Flow heaters, the pressure relief door is at the rear of the heater; it is important that the minimum clearance at the rear of the heater is not less than 0.3 m to ensure safe operation.

**IMPORTANT:** For maintenance of the heater all of the upper panels need to be removed for the checking and replacement of insulation. Also the lower side panels are the only access for removal of the main fan, it is therefore necessary to have a minimum clear area of at least 1 m to one of the sides for this purpose.

There should be a clear distance of at least 4 m from the discharge heads to ensure free flow of warm air.

## 3.3 Air Supply (Plant Rooms)

It is important to ensure that there is adequate air supply at all times for both combustion and heating requirements. Particular attention must be paid to this point when the heater is installed in a separate room. Ventilation should prevent the Plant room temperature exceeding 32°C.

Any plant room containing air heaters will require permanent air vents direct to outside air in compliance with BS 6230. The air supply to and from the heater distrubution fan must be fully ducted through the plant room to the heater spigots to ensure that the fan does not cause negative pressures in the room.
Where mechanical ventilation is used, it shall be by mechanical inlet and with either natural or mechanical extraction. Systems of ventilation employing mechanical extraction and natural air inlet shall not be used.
Automatic means, such as interlocks, shall be provided for installations where equipment failures can lead to hazardous situations developing.

### 3.3.1 Return Air Ducting

In installations employing recirculation or fresh air ducting this ducting shall comply with the following.

(a) There shall be an unobstructed air path connected directly to the heater.

(b) The return air or fresh air shall be connected by ducting directly to the air inlet on the heater.

(c) Where automatic or manual dampers are provided for operational adjustment in these ducts, they shall be proved in the correct position during the operation of the burner.

The main fan requires a minimum free air return path of 1 $m^2$ per 197 kW of heater output or 0.33$m^2$ whichever is the greater.

***Note**:* When heaters are installed in the horizontal mode, connected to distribution ducting and/or inlet ducting then the natural convected air flow through the heater, before the main fan turns on, may be disrupted.

To ensure correct operation of the fan under these circumstances, all COMBAT® cabinet heaters designed for horizontal mounting have the main fan designed to operate in conjunction with the burner sequence by the use of a time delay or direct acting relay.

It is strongly recommended that when any heater is connected to installation ducting that a similar approach to the fan control is used. Any such control must be in parallel with the fan thermostat so that the fan "run on" feature is still able to operate (see the wiring diagrams in Section 6 for details).

## 3.4 Building Ventilation

In buildings having a design air change rate of less than 0.5/h, and where heaters are to be installed in heated spaces having a volume less than 2.2 $m^3$ per kilowatt of total rated heat input for heaters fitted with forced or induced draught burners; grilles shall be provided at low level (i.e. below the level of the appliance flue connection) except that:

Most traditional building constructions will provide air changes of at least 0.5/h without the need for ventilation openings.

For heaters installed in buildings with a design air change rate 0.5/h or greater, and where the volume of the heated space is greater than 4.7 $m^3$ per kilowatt of total rated heat input, as appropriate additional high and low level ventilation will not be required.

Where necessary ventilation air shall be taken from an outside point where it is not likely to be contaminated, for example with smells, road vehicle exhausts, dry cleaners, exhausts, solvents, etc.

The minimum quantity of outside air required for ventilation shall be at least that required for personnel within the building.

Where the heaters are located in the heated space the air supply requirement is not necessarily the sum of the individual requirements for combustion, ventilation and dilution air, and fresh air, but the greater individual requirement.

Where there are any flued appliances in the room and where outside air is supplied mechanically and there is mechanical extraction, the design extract rate shall be 5% to 10% less than the design inlet rate so that the room will be at a higher pressure than the outside air.

# *Section 4*. Installation of the Heater

## 4.1 Flue

Each heater must be fitted with at least one metre of an individual and correctly sized stainless steel flue, (see Table 2.1 for flue sizes) which must carry all products of combustion to outside the building in accordance with these instructions and local regulations.

Suitable flue may be obtained from Roberts-Gordon.

No other appliance may be connected to this flue.

The flue must be terminated at least one meter higher than the section of the roof it intersects (see Fig 3.1). Furthermore if the point of intersection with the roof is within 2.5m of a nearby structure, the terminal must be at least one meter above that structure .

It is important that the flue is designed to prevent the adverse effects of down draughts causing excess pressure in the combustion circuit. If such excess pressure is being produced, (see maximum flue pressure in the data tables), then it is recommended that the terminal is at least one metre higher than the highest point of the roof .

The top of the flue should be fitted with a terminal or rain cap.

If a flue extends more than 2 m above the roof it should be supported by guy wires. (See Fig. 3.1).

90° bends and horizontal pipe must **not** be used in flues except for the immediate flue connection to horizontally mounted heaters where the transition to a vertical flue must be within as short a distance from the heater as is possible. Normally the transition to vertical will be no more than one metre from the flue spigot.. As a guide where it is necessary to use 135° bends to offset a flue, at least 1 m of vertical flue must be added to the minimum requirement for every 2 x 135° bends or 0.3 m of non vertical flue.

No draught diverters or stabilisers should be fitted to the flue.

The assembly of the flues from the heater to below the weather sealing collar should be with their sockets facing upwards. Above the weather sealing collar the sockets should be facing downwards. The joints are to be secured with monel blind rivets or sheradized P.K. screws. If condensation is likely to occur in the flue, then provision should be made for drainage.

The flue should be sealed into the female spigot of the heater using a heat resistant rope and fire cement.

If the flue passes through a wall or ceiling of combustible material it must be enclosed by a sleeve of none combustible material and separated from the sleeve by at least 25 mm air gap. The temperature of any combustible material near the flue or heater must not exceed 65°C when the heater is in operation. The flue must also be at least 50 mm from any other combustible material. The joints between the flue and roof or wall must be made good to prevent water ingress.

The flue should be installed and supported so that the heater does not carry any flue weight and the installation must comply with the relevant codes of practice (see Section 3.1).

## 4.2 Electrical Supply

A 230 volt 50 Hz single phase supply is required for all heater Models 015 to 030 connected to the heater terminals $L_1$, N & Earth.

Standard models 040 to 0100, and all High Flow models require a 400 volt 50 Hz three phase and neutral supply connected to the heater terminals $L_1$, $L_2$,$L_3$, N, and Earth.

All heaters and controls must be correctly earthed. All external wiring must comply with the relevant IEE and local regulations and be carried out by a qualified electrician.

It is important that "L & N" polarity is correct for these heaters as incorrect polarity may prevent the burner control box from operating properly. It is also important that the voltage between N and earth is at 0v and can never exceed 15v.

**Note:** Roberts-Gordon can supply a special isolating transformer to provide a suitable treatment of the supply to the burner, where there is a problem on the electrical supply with respect to voltage between N and Earth.

An isolator with a contact separation of at least 3 mm on all poles should be installed adjacent to the heater, but not attached to it, to disconnect all supplies to the heater and where necessary to isolate the remote control panel.

The final connection to the heater should be made in metal sleeved flexible cable or flexible conduit to the main terminal block under the front lower panel of the heater using 1 sq. mm cable on all models (except Model 0100 and High Flow models with 5.5kW or 7.5kW motors) when 1.5 sq. mm cable should be used. Cable entry is provided into the rear horizontal frame of the cabinet.

## 4.3 Remote Controls

### 4.3.1 Individual Controls

All the heater controls for the COMBAT® range are to be site wired remote from the heater. The minimum control would be a room temperature control thermostat wired between terminals 2 and 3 of the heater. Extra controls will be required for burners with High.Low or Modulating operatein see 4.3.1.1

All controls must be voltage free from external sources.

Where a time switch and/or manual switch are installed then these should be wired in series with the control thermostat.

### Siting of Thermostats or Temperature Sensors

When siting a remote control thermostat or temperature sensor it should be fitted on a wall or column at a height of 1.5m from the floor of the room being heated.

It is important for comfort and fuel economy to site the thermostat where it will monitor an average room temperature i.e. keep clear of draughts from doors or windows or from the direct path of heated air from the heater. Areas of little air movement, e.g. corners, should also be avoided.

Where a remote Frost Thermostat is being used, it should be sited within the heated space adjacent to the most vulnerable equipment that requires protection.

### 4.3.1.1 Controls for High/ Low Burner Operation

For heaters that incorporate an Ecoflam High/Low burner then the on site controls will need to provide the two stage signal to operate these burners.

This is best provided by a two stage thermostat so that the setting of the thermostat ensures that the two set points are correctly related.
The thermostat may control the heater outlet temperature if the heater is designed for a duct distribution system or the room temperature.

The site wiring will be across terminals 2 & 3 for any time control and the on/off function of the burner (stage two) and across terminal 2 & 8 for the low fire (first stage ) setting.

The burner will then operate as follows:

- Temperatures from cold up to the first stage set point - Full fire at the maximum rate
- Temperatures above first set point up to the second set point - Low fire at the minimum rate
- Temperatures above the second set point - Off

### 4.3.1.2 Controls for Fully Modulating Burners

For heaters that incorporate an Ecoflam fully modulating burner then the Landis & Staefa temperature control is provided with the heater. The Landis & Staefa control provides the temperature control and the on site wiring of the temperature sensor is required along with any time control required on site.

The heater will normally be controlled by the temperature of the air in the outlet duct, but it is possible to control on room temperature.

The position of the sensor in the outlet duct is to be determined on site as all installations differ.

By using a suitable thermometer select a position in the outlet duct approximately 1 meter from the heater and look for a position across the cross section of the duct that provides a reasonable average of the temperatures found. Mount the sensor as close to this position as possible for best results.

It must be noted that when operating at reduced heat input the leaving air temperature may be low when controlled on room temperature.

The Time control and any other on/off controls will be across terminals 2 & 3.
The sensor will be connected to terminals 8 & 9

The operation will then be:

- The burner will fire and once the burner sequence reaches the release to modulation stage the Landis & Staefa control will begin to monitor the outlet temperature.
- The control will then adjust the burner input continuously to attempt to maintain the set temperature on the control.
- Should the temperature continue to rise even though the burner is operating at minimum fire then the control will turn off the burner until the temperature falls again when the burner will restart automatically.

If a switch etc. is required to turn on the main fan for ventilation, then this must be voltage free, from external sources, and may be connected between: Terminals $L_1$ and 1 for all models 15 to 30 or Terminals 2 and 1 for all other models.

## 4.4 Fuel Oil Supply

### 4.4.1 Fuel Storage Tank

The fuel oil storage tank should be located as close as possible to the heater, but outside of the building. The tank must not be mounted directly on the ground but should be raised clear of the ground on suitable trestles, and/or located in a concrete or metal catch pit. The catch pit should be constructed to have a net volume of at least 10% greater than the volume of the tank, and be oil tight.

### 4.4.2 Fuel Pipes

The fuel pipes must be sized to ensure an adequate supply of oil to the entire installation. Galvanised pipe must not be used on oil installations (see Table 2.3 for fuel usage).

The fuel pipe must terminate at each heater with an isolating manual valve, a fire valve and a fuel filter (see Fig. 3.1). The fusible link of the fire valve should be installed so as to be 100 mm (4 inches) above the burner.

The heater's oil burner pump inlet is provided with a flexible oil line which should be used for the final connection.

When making the final connection to the heater, care should be taken not to impede the removal of any of the removable panels of the heater. All COMBAT® oil fired cabinet heaters are supplied with burner pumps fitted for one pipe systems.

### 4.4.3 Gravity Feed System

The simplest installation is a gravity feed system as in Fig. 3.1. This system relies on the head of the fuel in the tank to push the fuel through the system.

### 4.4.4 B. M. Oil Lifter

Where a gravity feed system cannot be used, a B.M. Oil Lifter may be used for small installations up to the equivalent to a single model 050 on minimum lift or a single model 020 on maximum lift (see Fig 4.1).

The fuel output from the oil lifter is gravity fed.

The B.M. Oil Lifter requires a constant 230 volt 50 Hz single phase electrical supply adjacent to its position. The maximum pipe size to be used on the suction side is 1/4" I.D. (5/16" O.D. (8mm)); for maximum loading of oil lifters refer to graph on Fig. 4.1. Consult the manufacturers information regarding the need to prime these devices.

### 4.4.5 Pressurised Systems

For larger installations a pressurised system may be used. In this type of system a pump draws fuel from the tank and then pushes it through the installation under pressure. The pressure is controlled at the pump by a pressure relief valve at approximately 0.8 BAR (12 psi ).

When a pressurised system is used, a pressure reducing valve set at approximately 0.3 BAR (5 psi), should be installed on the fuel inlet to each heater after the manual isolating valve. This is to protect the oil burner pump from the danger of possible over pressure under fault conditions.

Fig. 4.2 shows a suggested scheme.

The electrical supply for the pumped installation will depend upon the type of pumps chosen, but will normally be set to run continuously.

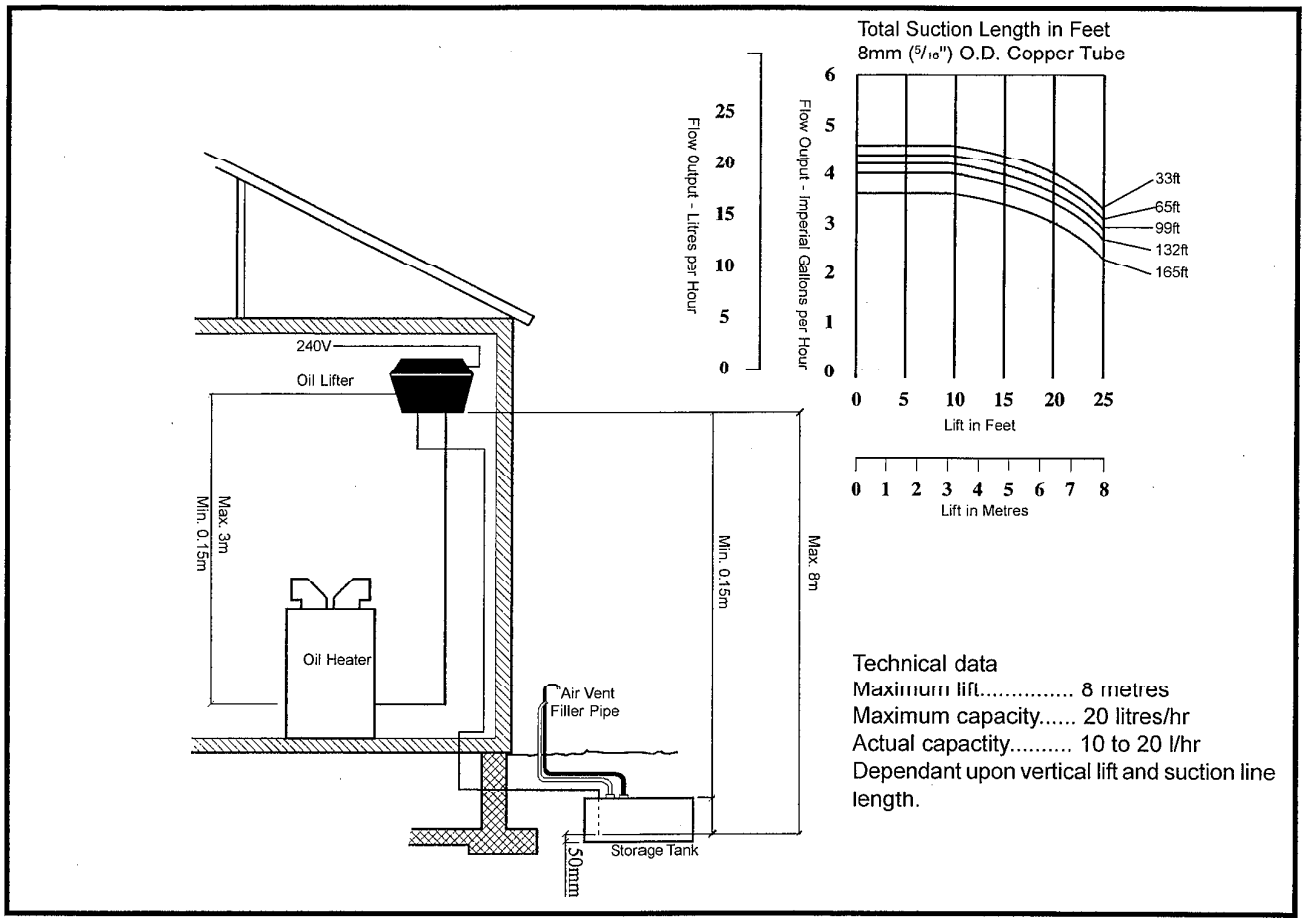



**Fig 4.1 B.M.Oil Lifter**

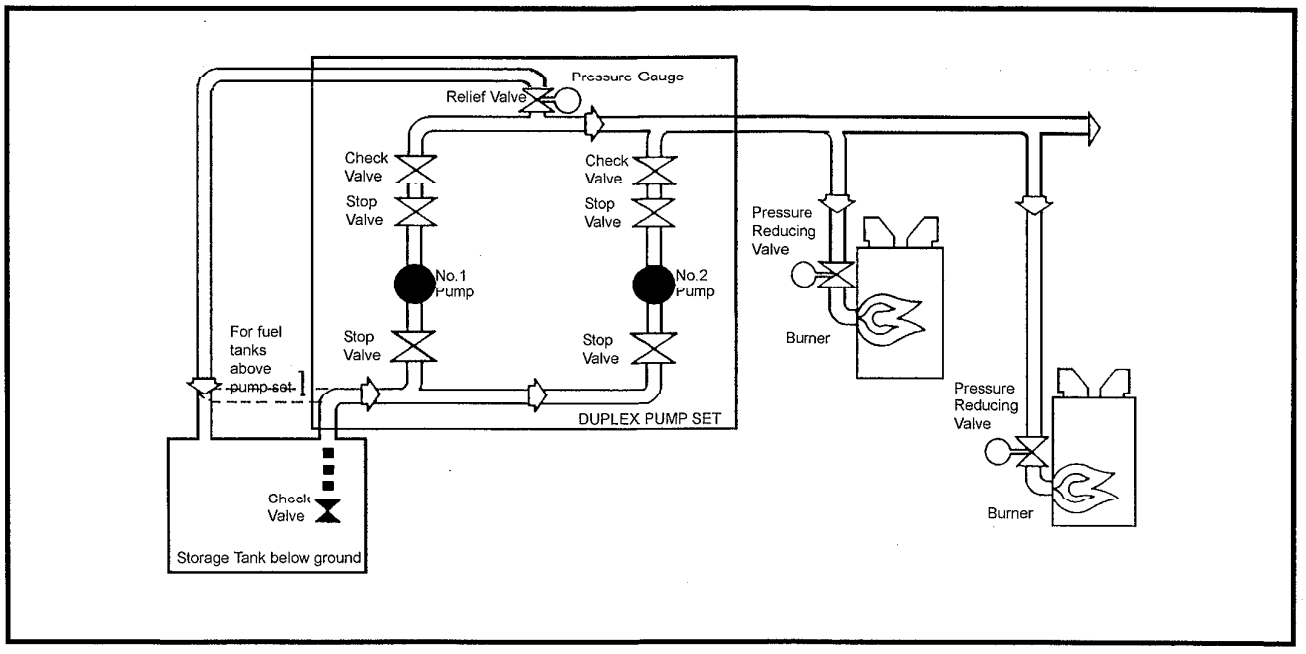



**Fig. 4.2 Pressurised System Installation - Duplex System**

(The system shown has one pump for run and the other for stand by. The valves allow the stand by pump to be removed for maintenance whilst the system is still running).

## 4.5 Gas Supply

### General

The installation must comply with local laws and regulations, and the complete installation including the meter, where fitted, must be purged and tested for soundness.
The gas supply must be adequately sized to carry a sufficient quantity of gas at the specified pressure at the heater inlet whilst firing (see data tables in section 2).

The gas supply must be sized to supply the correct amount of gas to the heater under all load conditions.

It will generally be required to use installation pipes of a larger diameter than the heater inlet connection.
The supply should terminate at each heater with a service cock and a union so as to facilitate the removal of the gas train for servicing (see Fig 3.1).

### Natural Gas

The gas meter and service must be checked by the local gas supply undertaking to ensure that it is adequate to deal with the total connected load of the completed installation.

Each heater must be provided with gas having the inlet pressure controlled at 20 mbar (17mbar - 25mbar)

### L.P.G.

For L.P.G applications each heater must be provided with gas having an inlet pressure controlled at 37mbar (25mbar - 45mbar) for propane (G31).

# *Section 5.* Commissioning the Heater

## 5.1

Commissioning is to be carried out only by competent personnel. Gas fired heaters must be commissioned by a C.O.R.G.I. registered engineer.

Any faults found during this procedure **must** be corrected before progressing any further with the commission.

It is important to read and understand this section and the burner Manufacturer's Instructions fully before commencing the commissioning of the air heater.

No attempt to start any part of the air heater should be made prior to ensuring that it has been correctly installed and that the components are satisfactory for the voltage, or pressures that are specified.

Follow Section 5.1 for pre commissioning checks and then:
Section 5.2 for oil fired heaters along with the burner manufacturer's instructions and
Section 5.3 for gas fired heaters along with the burner manufacturer's instructions.

***Note:*** manufactures instructions may be general instructions for the application of their burners to any product. Where specific detailed settings are referred to in this instructions book they should be followed, as they represent the agreed settings when used on COMBAT® Cabinet Heaters.

***Note:*** During the commissioning instructions, reference is made to the information in the Data Tables in Section 2. It is important that reference is made **only** to the Data Table which relates to the burner option fitted to the heater as indicated by the burner reference letter on the data plate and for the correct fuel type.

Any manufacturing seals that are broken during the on site commissioning must be re-sealed following the completion of the commissioning so that subsequent adjustment by unauthorised persons is deterred.

### 5.1.1 Pre Commission Checks - All Heaters

### 5.1.1.2 Electrical Tests

Ensure that the electrical supply has been correctly connected. This to include:

### 5.1.1.3 Earth Continuity Check

The earth continuity must be a resistance of less than 0.1 ohm when a test is taken between any appliance's earth point and the main incoming earth at the isolator.

If a higher reading than this is obtained, the fault must be traced and rectified, preferably by an electrician, before continuing with the commission.

### 5.1.1.4 Polarity Test - Single phase

Connect one lead of a suitable voltmeter to earth and connect the other lead to the live supply terminal at the heater $L_1$.

Turn on power to heater. A reading of approximately 230 volts AC 50Hz should be found.

The same result should be obtained by connecting the test leads from live to neutral.

Connecting the voltmeter between Neutral 'N' and Earth should give a reading of 0 volts. If these tests do not conform to the above there is a fault which must be rectified before progressing further with the commission. An electrician should be consulted to carry out this work.

***Note:*** The burner control box may not operate with a neutral to earth voltage above 15v. and may be unreliable at any reading other than 0.

### 5.1.1.5 Polarity Test - Three Phase

Connect one lead of a suitable voltmeter to earth and connect the other lead to each live supply terminal at the heater in turn $L_1$, $L_2$ & $L_3$. A voltage of a approximately 230v should be found between each phase and Earth or Neutral.

The voltage between and two phases should be approximately 400v.

See 'Single Phase' above for testing Neutral to Earth.

### 5.1.1.6 Fan Rotation Check

Switch on the electricity supply at the isolator and the manual switch to 'fan on' (if there is no remote fan switch installed then press in the white button of the combination fan/limit thermostat). On three phase heaters check the rotation of the main air moving fan. This should be clockwise looking at the drive end. If rotation is not correct, turn off the isolator and change over any two of the incoming supply phases and recheck. It will be necessary to remove the lower front or right hand side panel to see fan rotation.

## 5.1.2 Electrical Settings

### 5.1.2.1 Combination Fan/Limit Thermostat Settings Check

Check the settings on the combination fan/limit thermostat. The three hands from left to right should be set approximately as follows:
Any manufacturing seals that are broken during the on site commissioning must be re-sealed following the completion of the commissioning so that subsequent adjustment by unauthorised persons is deterred.

| | | | |
|---|---|---|---|
| Hand 1 | Fan Off temp | 38°C | (100°F) |
| Hand 2 | Fan On temp | 60-65°C | (140-150°F) |
| Hand 3 | Limit temp | 110°C | (230°F) |

**WARNING**
**DO NOT ROTATE THE DIAL BY HAND AS THIS MAY CAUSE PERMANENT DAMAGE TO THE MECHANISM.**

The link must be removed between the two switches on this device (see Fig. 2.3).

### 5.1.2.2 Fan Motor Overload Check

On three phase belt drive heaters check the correct setting of the fan motor overload (See 2.4) this should be 0.2 amps above the rated running current on the heater data plate or see Table 2.1.

## 5.2 Commissioning the Burner - OIL HEATERS

Check all valves between the fuel tank and the heater are open, including the fire valve (i.e. cable is tight).

Ensure that oil is available at the heater inlet (see Fig. 3.1) and that the air has been vented from the fuel pipe installation. This can be achieved by slackening the bleed screw on top of the fuel filter.

**i)** On pressurised systems; check that the installation is running at the correct pressure (see 4.4.5).

**ii)** B.M. Oil Lifters will need priming (see manufacturer's leaflet).

### 5.2.1

Ensure the burner head and air damper settings are adjusted in accordance with the Data Tables for the correct burner and that the correct atomising nozzle is fitted (See burner reference letter on the heater data plate).

### 5.2.2 Preparation of Test for Burner Pressure

Attach a pressure gauge 0-15 BAR (0 - 200 psi) to the burner pump pressure test port. (See Manufacturers Information) A test manifold gives the facility for the connection of the pressure gauge and venting of the pump.

### 5.2.3 Switching On

**i)** Operate the external controls to turn the heater on. (Heat ON position).

***Note:*** The burner plug and socket may be used to turn off the burner during commissioning.

**ii)** If the 'lockout reset' button is illuminated press in to reset.

The combustion air fan and electric ignition should work immediately (the latter can be heard as a crackling sound at the burner).

Section 2.2. gives full sequence details.

Vent the burner oil pump at the same time (the pump must be running).

If the burner goes to 'lockout' before the pump has vented, reset the control box, and repeat 5.2.3. until all the air has been vented from the pump and the burner fires.

***Note:*** Wait one minute before attempting to reset the control box.

**WARNING**
**THE CONTROL SHOULD NOT BE RESET FROM LOCKOUT MORE THAN THREE TIMES WITHOUT IDENTIFYING AND CORRECTING THE CAUSE. RESIDUAL FUEL OIL IN A COMBUSTION CHAMBER IS AN EXPLOSION RISK.**

### 5.2.4 Adjust Burner Oil Pressure

Adjust the burner oil pressure to the value for model given in the data table for the burner reference letter and burner manufacturers information for details of the burner oil pump.

When completed turn off burner and remove test gauge and refit port plug.

### 5.2.5 Set Combustion Air

The combustion air must now be set. This is carried out by measuring the emissions in the flue at a point within one metre from the outlet of the heater and adjusting for the highest carbon dioxide ($CO_2$) levels obtainable, usually 10.5 - 11.5%, whilst making little or no smoke (smoke number 0 -1). Tests must be carried out with all covers fitted and after the heater has been running for at least 15 minutes.

Closing the combustion air damper (reducing number) will raise both $CO_2$ and smoke number. Conversely opening the air damper (rising number) will reduce these levels.

### 5.2.6 Completion

Recheck and note all results and settings on the commissioning data sheet at the rear of this these instructions. Test burner for correct start and stop operation, several times. Check that all safety devices operate correctly.

Inspect the heater and pipework for any oil leaks and repair where necessary.

### 5.2.7 Hand Over

Replace all covers panels or caps removed during commissioning securely. Hand these instructions to the user or leave them at the heater. Explain to the user the operation of the heater, this should include:

Starting and stopping the heater.

How to set the time switch (where fitted)

How to set the thermostats and their position.

What to do if the heater does not operate.

How to vent air from the fuel system.

How to measure the fuel in the storage tank.

The grade of fuel to be used.

Any other points on the installation that the user may need to know.

## 5.3 Commissioning the Burner - GAS HEATERS

Follow section 5.1.1 to 5.1.2.2 for preliminary checks.

Note: Ecoflam **High/Low** and **Modulating** burners have extra specific requirements. Follow the manufacturers instructions using the setting data provided in these instructions in section 2.

It is important when setting the minimum firing rate to check on site that the flue temperature does not fall below 150°C when running for prolongued periods of low fire. The minimum firing rate must be increased above the minimum stated in the data tables to ensure this situation. Failure to take acount of flue temperature will cause the combustion products to condense. This will cause water leakage problems and heat exchanger life problems.

### 5.3.1 Preparation of the Burner

Ensure the burner head, air damper and pressure switch settings are adjusted in accordance with the Data Tables for the correct burner (see burner reference letter on the data plate).

### 5.3.2 Carry Out A Dry Run

To prove the safe operation of the controls allow the burner to cycle without gas turned on.

With the gas service cock still in the off position, turn on the electric supply to the heater and observe the burner operation as it goes through the cycle of events.

### 5.3.3 Switching On

Operate the external controls to turn on the heater (Heat ON position). If the 'lockout reset' button on the burner control box is illuminated, press in to reset.

***Note:*** The burner plug and socket may be used to turn the burner off and on during commissioning.

After a short delay the combustion air fan should run. (see Section 2 for full sequence times).

After the purge period, the electric ignition will turn on (this can usually be heard as a crackling sound at the burner), followed quickly by the start gas valve (Main Gas Valve for models 15 to 30) opening.

The control box will now go to 'lockout' as no flame will be present.

If the control box goes to 'lockout' after 5 seconds of the purge period, this may be due to the air pressure switch being set too high, (turn it's adjustment down slightly), or the burner fan not being connected correctly (see Burner Manufacturer's Instructions and reset the lockout button).

Before continuing with the commission carry out the gas valve proving tests described in the Burner Manufacturer's Instructions.

### 5.3.4 Fire the Burner for Dungs Combination Gas Valves

Open the gas isolating valve.
Connect a suitable pressure gauge to the burner pressure test point.
On models 040 or larger, to ensure that start gas only may pass to the burner, remove the gas valve electrical plug for main gas valve. Reset the lockout button of the control box and carry out operation 5.3.4 again. The burner should now fire. If lockout should occur when the start gas valve energises (or main gas valve for models up to 030), repeat 3 or 4 times.
If after several attempts, the burner does not fire then turn the start gas governor adjusting screw (or main gas governor for models 015 to 030) 3 turns clockwise (see 5.3.6 below) and repeat until the burner fires.

### 5.3.5 Initial Setting

***Note:*** Miss out this stage for models 015 to 030
Once firing, the start gas pressure should be set to the value given in the Data Tables for the burner type and the model concerned (see burner reference letter on data plate). This is carried out by turning the governor adjusting screw (accessed under the screw on cover) clockwise to increase pressure, or vice versa.

### 5.3.6 Set Gas Rate

Switch off and refit the main gas valve plug, removed earlier to allow the main gas valve to operate. Switch on again and allow the burner fire and to settle for a few minutes. Adjust the main gas burner pressure to the value given in the relevant Data Table for the model concerned using the Main Gas Regulator accessed under the swivel cover (see Figs 2.6 & 2.7).

The results of setting the gas flow rate by using burner pressure only can lead to quite wide variations in heat input due to the nature of the burners used.
It is important to check that the gas rate set during the commissioning is within ± 5% of the required flow rate.
This may be achieved by wherever possible checking the gas flow to the heater by using the gas meter and timing the flow through the meter. The results should be compared with the required flow rate for the model given in the Data Tables, adjusting the burner pressure to correct for any error.

***Note:*** This must be carried out with all other appliances turned off, including any pilots.

### 5.3.7 Set Combustion Air - All Gas Valve Types

The combustion air must now be set. This is carried out by measuring the emissions in the flue at a point within one metre of the outlet from the heater and adjusting for the highest concentrations of carbon dioxide ($CO_2$) obtainable, usually 9.5% to 10% for natural gas and 11% for L.P.G. whilst making little or no carbon monoxide (CO); 10 parts per million (0.001%) is the maximum recommended. These tests should be carried out with all covers and panels fitted.

**To adjust for these results:**

Closing the combustion air damper will increase these values.

Opening the damper will reduce these values.

Once adjusted to the optimum combustion setting ensure that the combustion air damper is locked into position (see Burner Manufacturer's Instructions).

Due to the interaction between combustion air and burner gas pressure it is now advisable to repeat from 5.3.6.

### 5.3.9 Set Air Pressure Switch

**WARNING:**
**SETTING OF THE AIR PRESSURE SWITCH MUST ONLY BE CARRIED OUT AS PART OF A COMPLETE COMMISSION INCLUDING COMBUSTION TESTS.**

See manufacturers information.

**To set a pressure switch:**
Remove the cover of the air pressure switch - ***Note:*** **THIS EXPOSES LIVE TERMINALS.**

With the burner firing as set up previously, turn the setting dial of the pressure switch to the setting indicated in the data table for the model and burner reference concerned.
The pressure switches are designed to prevent the burner from producing dangerous combustion products under adverse conditions such as reduced supply voltage and blocked flues.

It is important that the settings indicated in the Data Tables are used and any unexpected operation of the pressure switches is fully investigated before any attempt to deviate from these settings is made.

### 5.3.10 Completion

After completing the commission, test fire the heater several times to ensure that it starts reliably and the safety and automatic controls function correctly. Fill in the commissioning data sheet at the back of this manual with the recorded settings and results. Ensure all the covers, caps and panels removed during commissioning are securely replaced.

**High/Low or Modulating Burners.**
Following setting the minimum firing rate a check must be made following the setting of the burner combustion .
The check is made by running the heater on low fire for a minimum of 15 minutes at the full transport air rate and at typical ambient conditions.
During the test check that the flue gas temperature does not fall below 150°C .Should the flue gas temperature fall below 150°C then the low fire gas setting must be increased to a value that will achieve 150°C flue gas temperature,otherwise condensation may form in the heat exchanger and flue causing rapid corrosion and short operational life."

**WARNING**
**Following commissioning operations, conversion to a different type of gas or adjusting the burner, any seal on gas adjusters or limit temperature settings that has been broken must be re-made.**

### 5.3.11 Hand Over

Hand these instructions to the user (or leave them at the heater), and fully explain the use of the user controls. This is to include:

Starting and stopping the heater.

Setting and operating the time switch.

Setting and operation of the thermostats (and their position).

What to do if the heater does not operate.

What to do if a gas leak is suspected.

The need for regular servicing.

Any other points regarding the installation that the user may need to know.

# *Section 6.* Wiring Diagrams

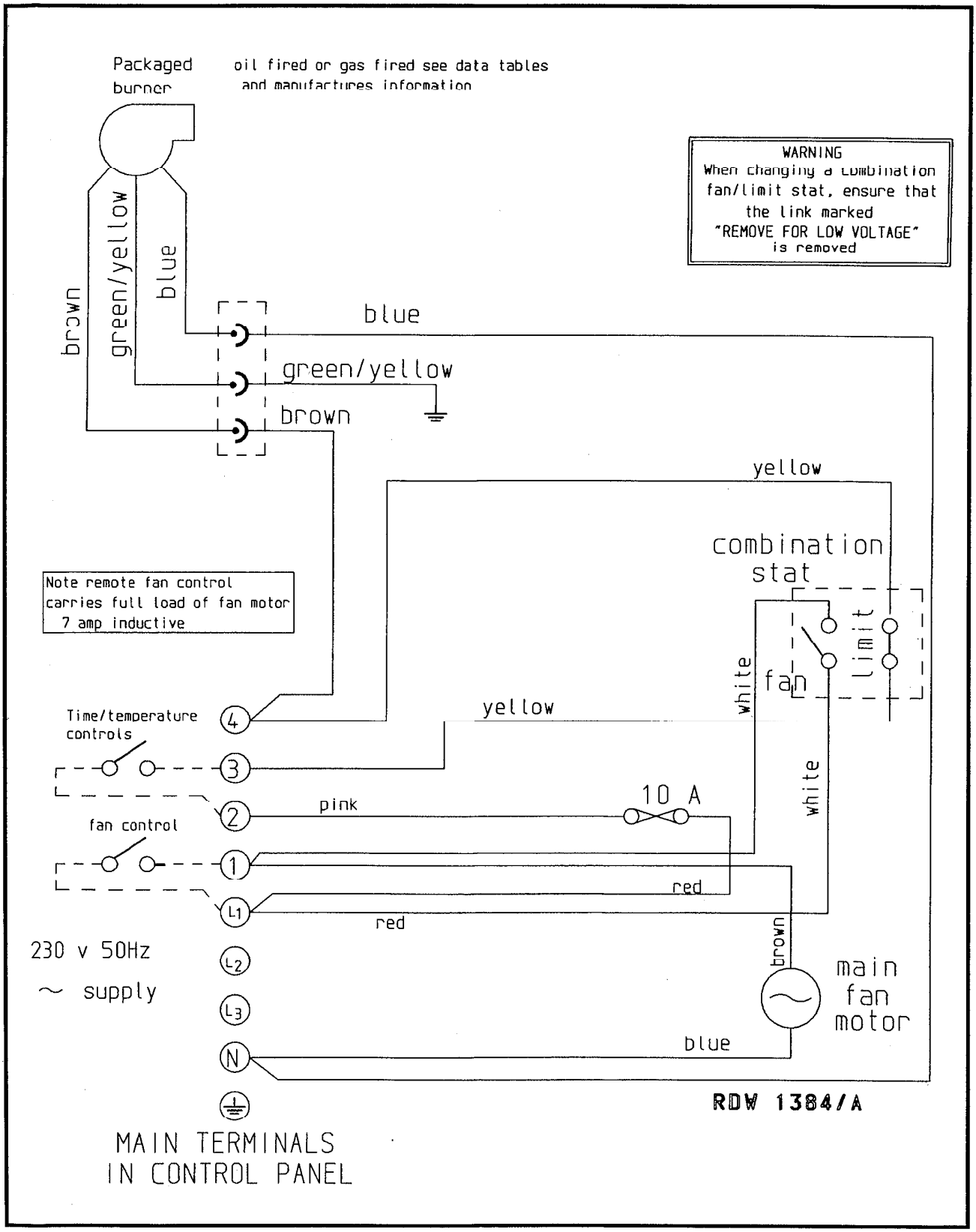



**Fig 6.1 As Wired Diagram for Models 15 to 30 - Floor Standing**

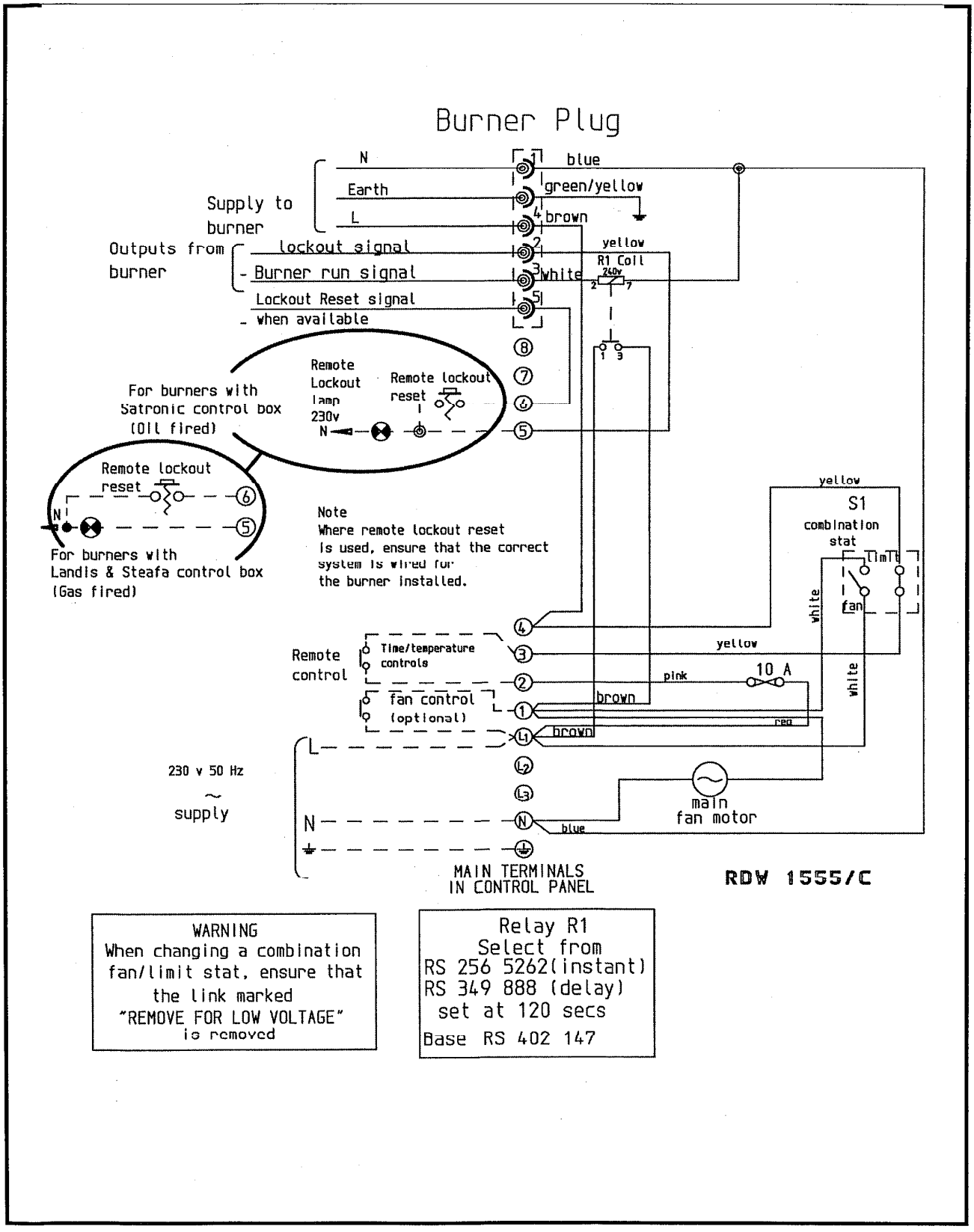



**Fig 6.2 As Wired Diagram for Models 15 to 30 - Horizontal Mounting**

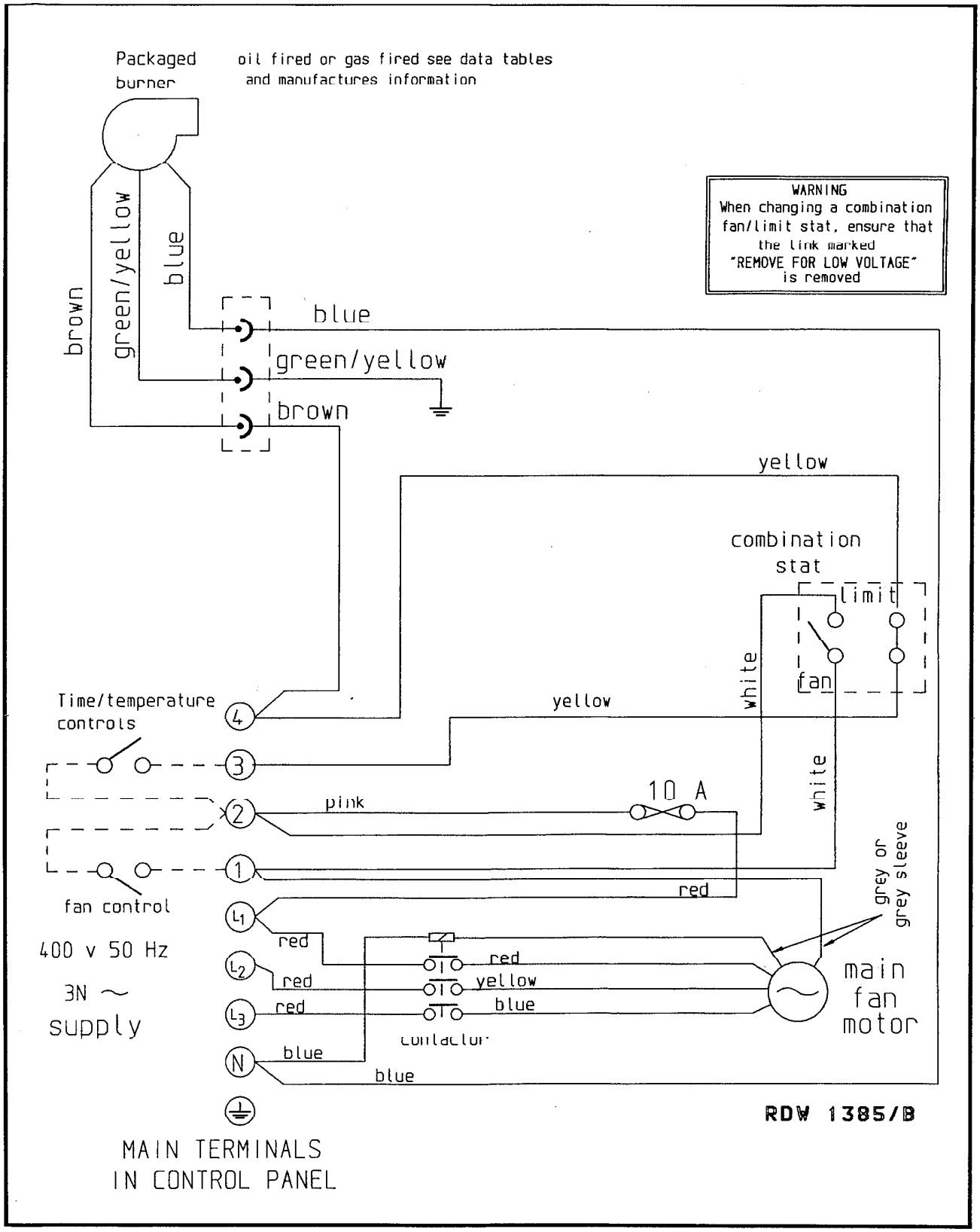



**Fig 6.3 As Wired Diagram for Models 40 and 50 - Floor Standing**

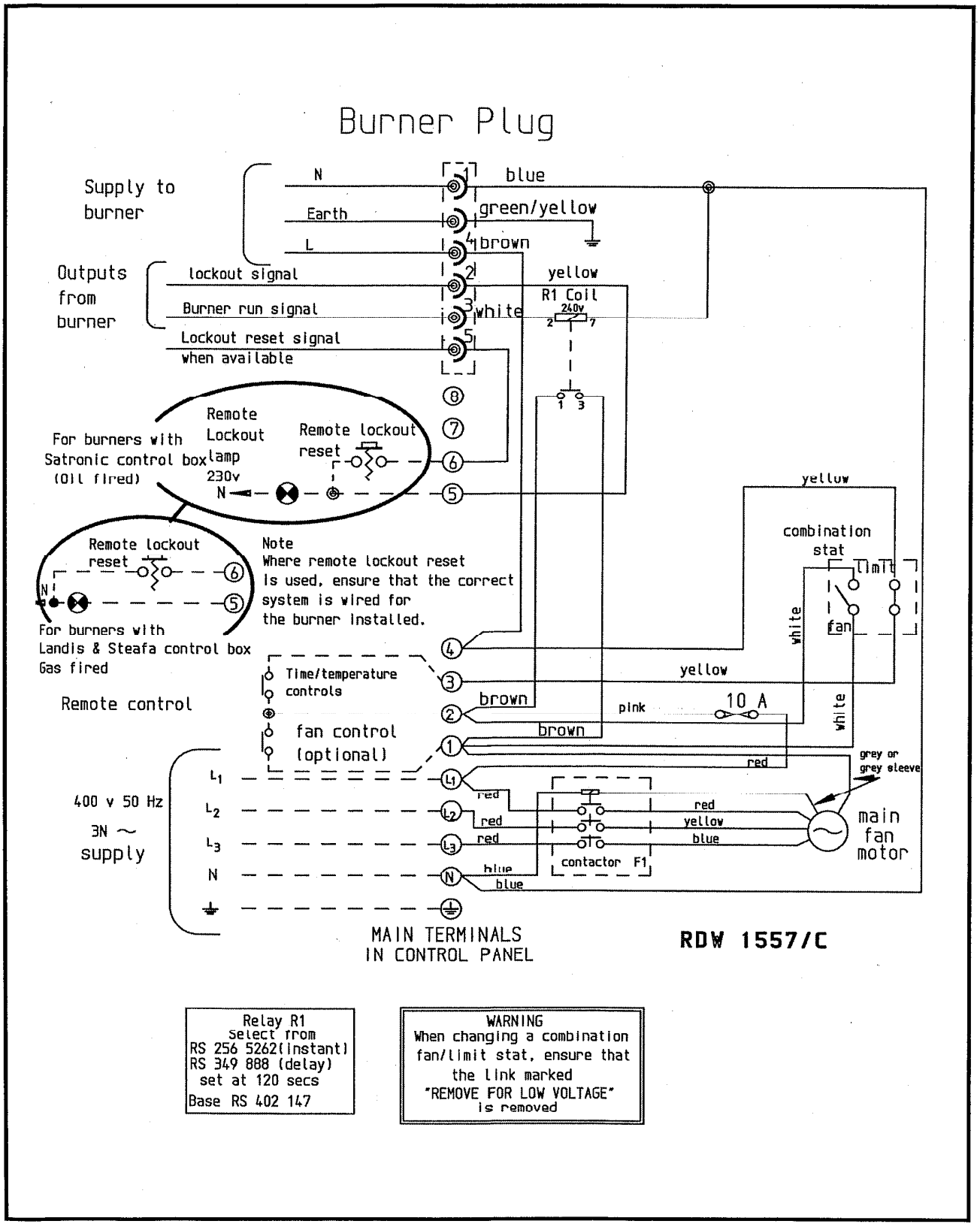



**Fig 6.4 As Wired Diagram for Models 040 & 050 - Horizontal Mounting**

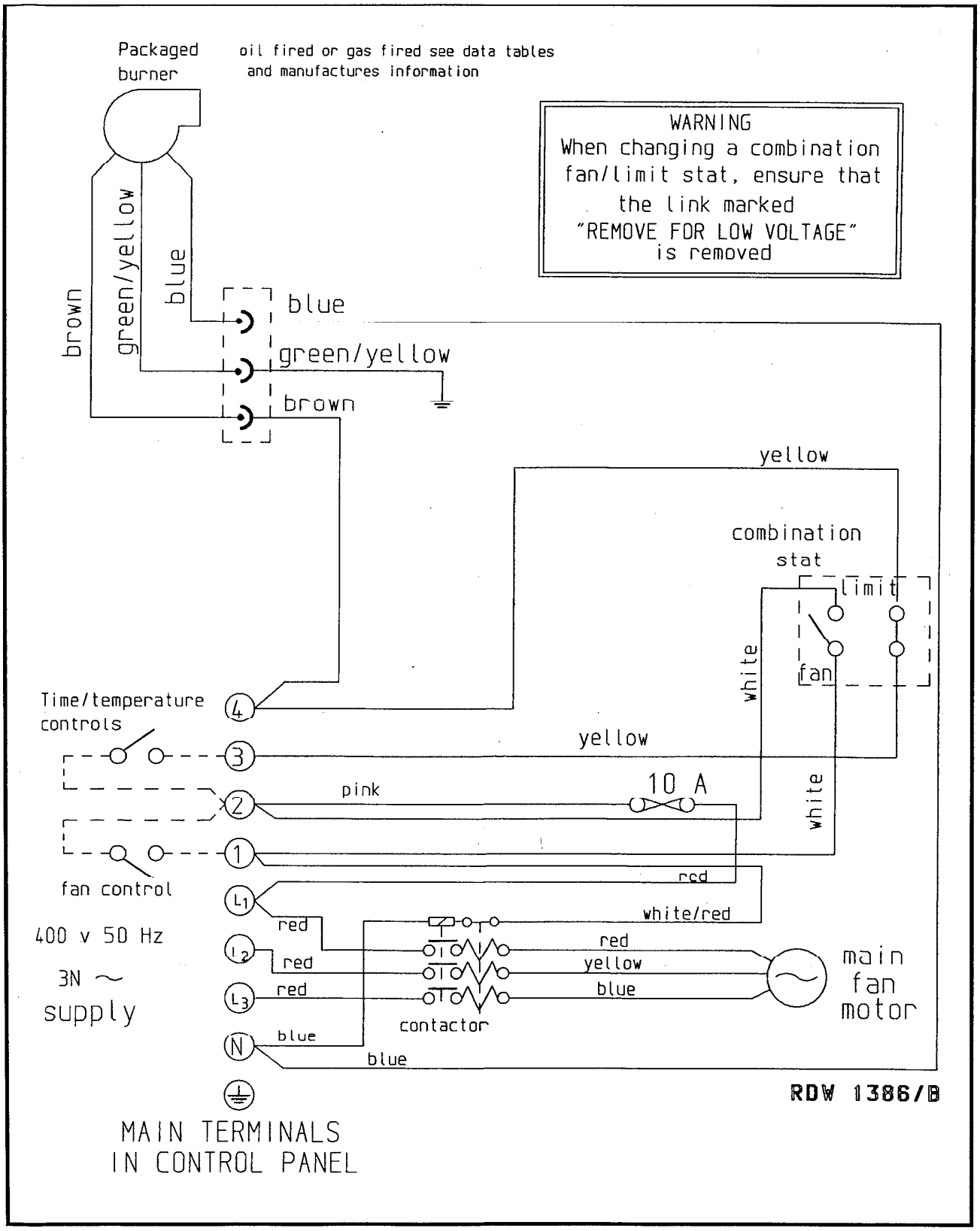



**Fig 6.5 As Wired Diagram for Models 60 to 100 - Floor Standing**

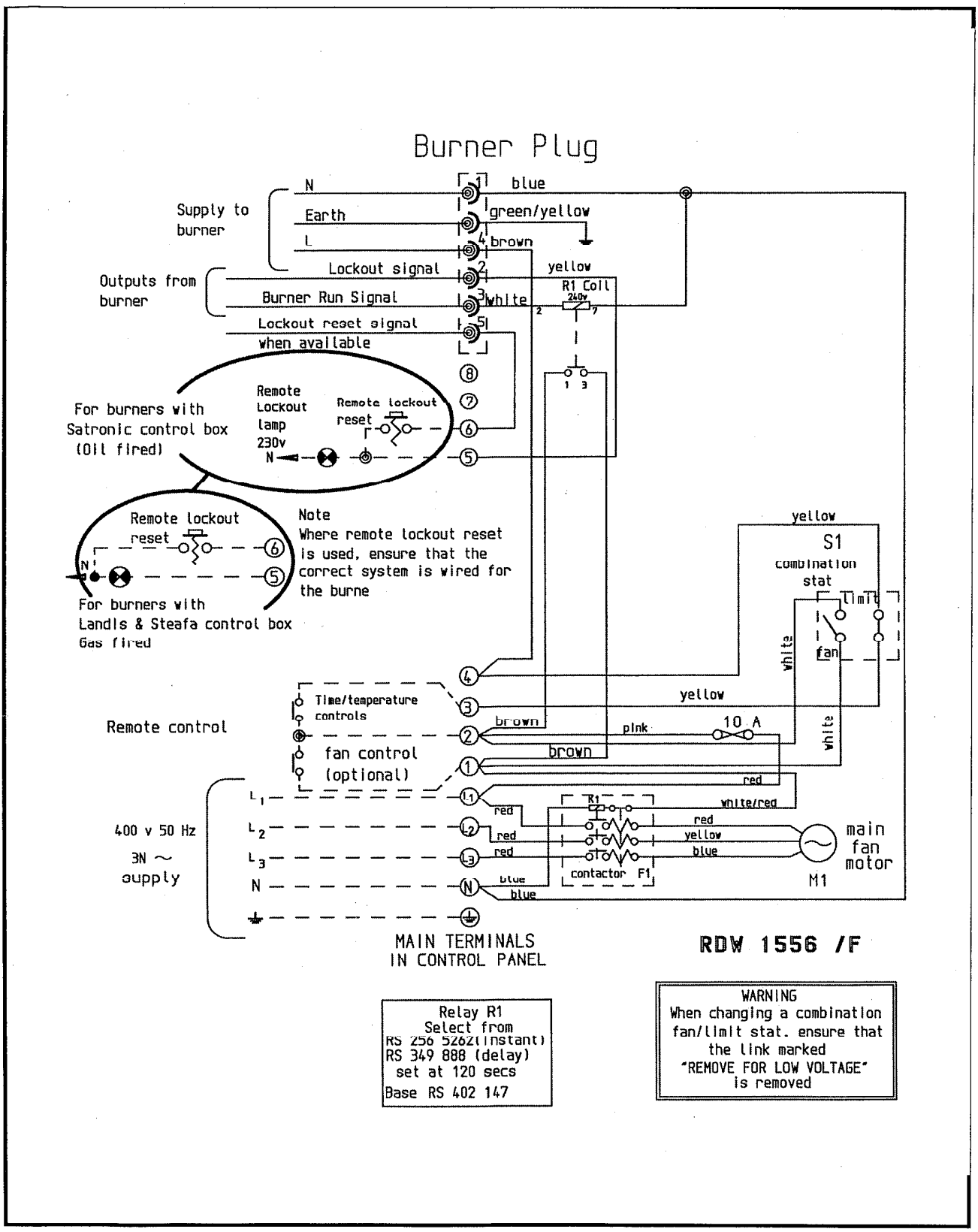



**Fig 6.6 As Wired Diagram for Models 60 to 100 - Horizontal Mounting**

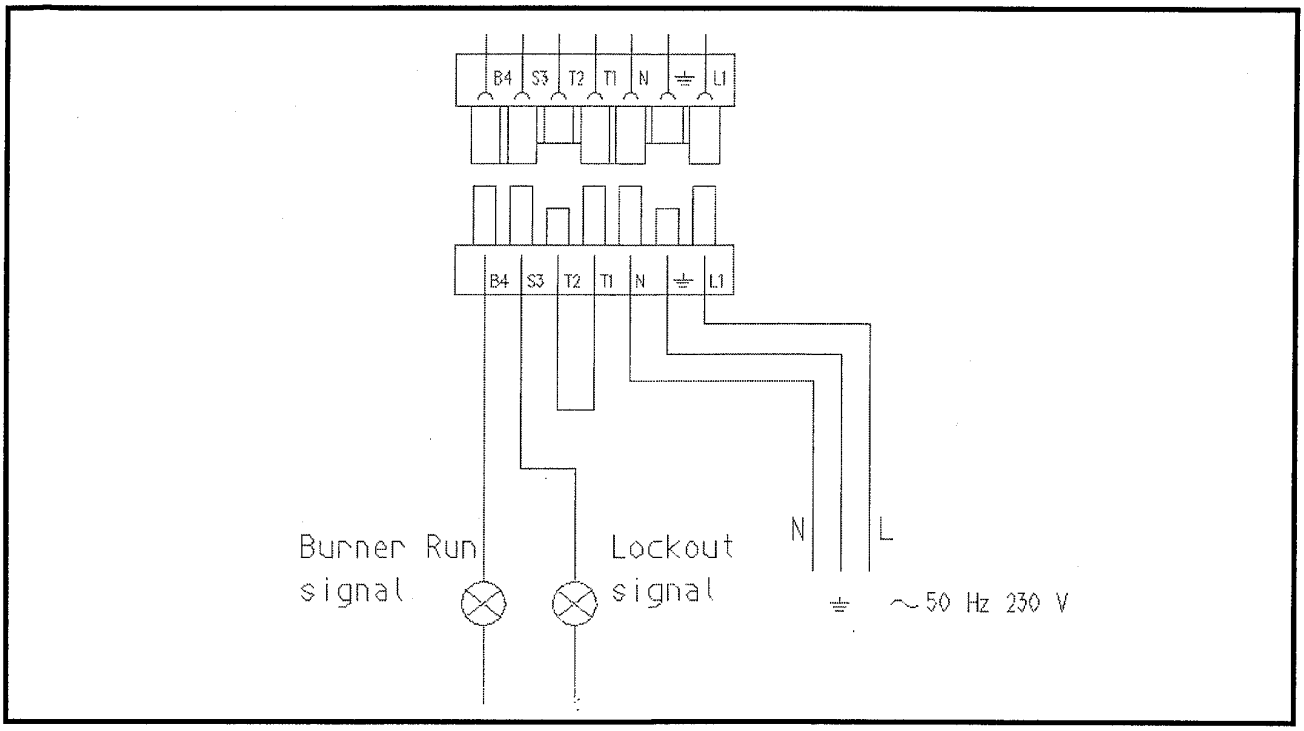



**Fig 6.9 Final Connections to Ecoflam On/Off Burners, All Models**

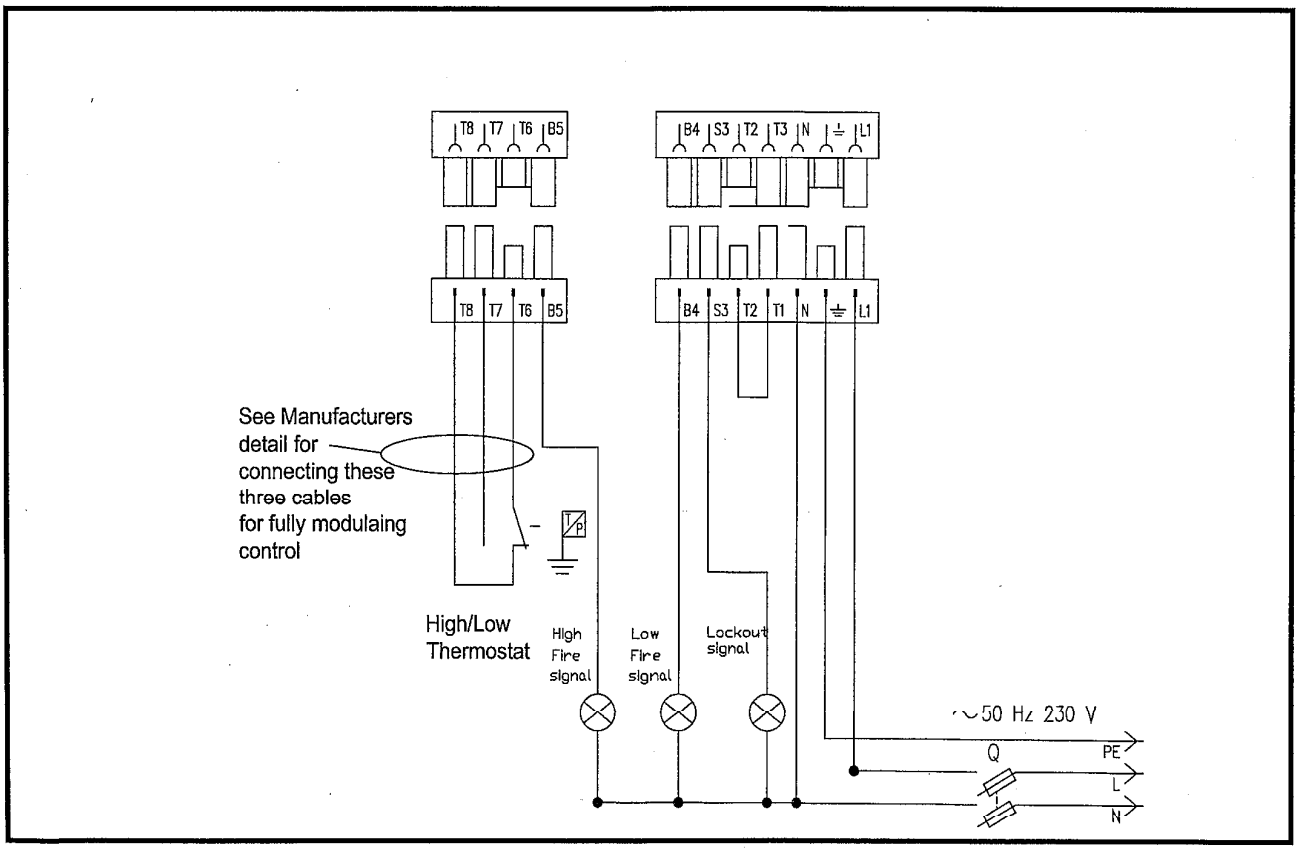



**Fig 6.10 Final Connection to Ecoflam High/Low or Modulating Burners, All Models**

## 6.1 Star Delta Starters

### 6.1.1 Lovato Star Delta Starter

The Lovato Star Delta starter is supplied ready for installation and no alteration of the internal wiring is required. The 230v coil circuit is connected to the two terminals 1 & 2 as shown on the diagram RDW1713 (Figure 4.4). The two links between terminals 3 & 4 and 4 & 5 also need to be added.

The START timer needs to be set to 3 and 5 seconds.

The relay adjustment on the timer may be ignored.

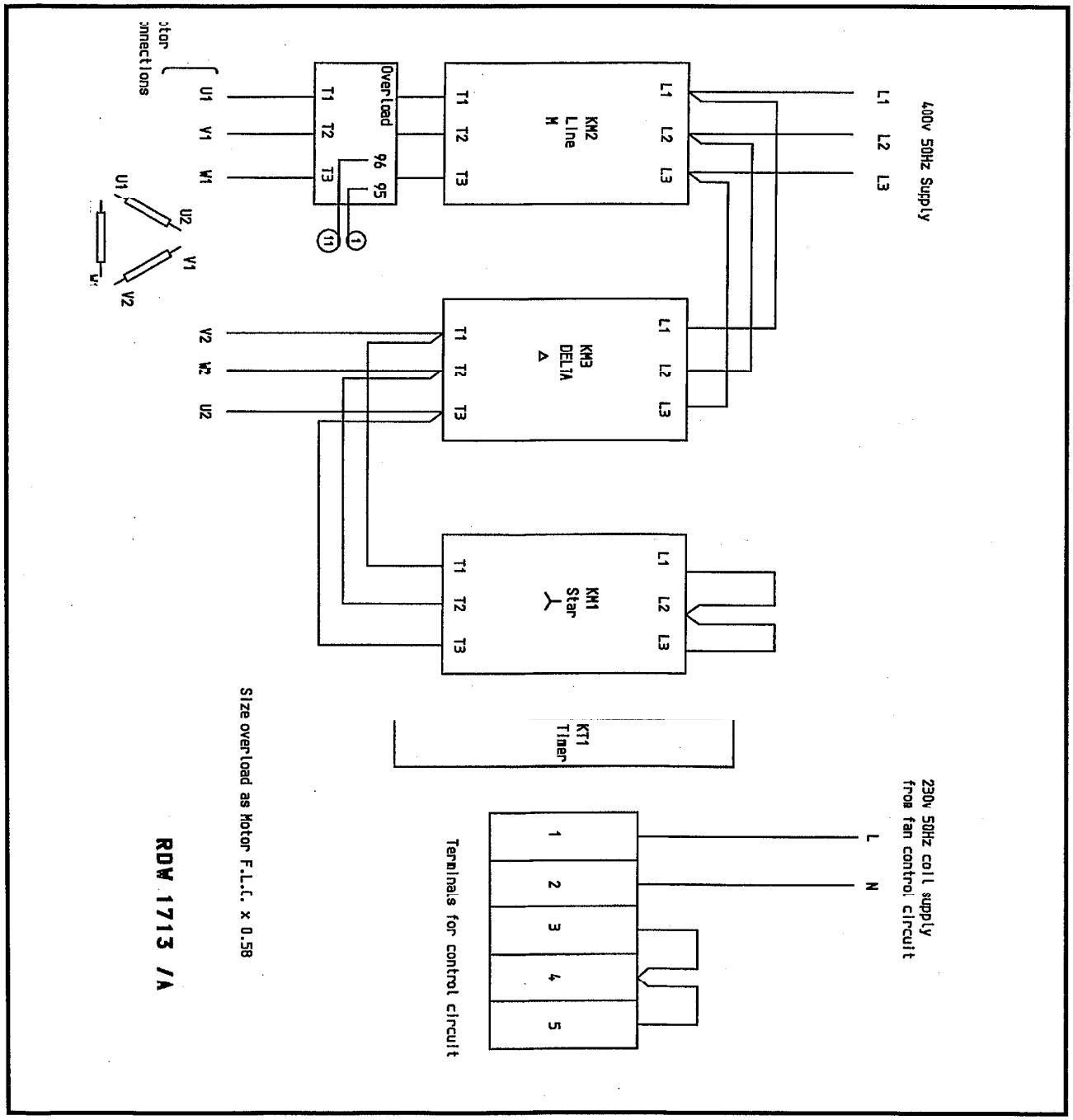



**Fig 6.14 Lovato Star Delta Starter**

# *Section 7.* Servicing Instructions

**WARNING**

**Only Competent and Qualified Engineering Staff should carry out SERVICING AND FAULT FINDING ON THIS EQUIPMENT.**

Before any maintenance is carried out, ensure that both fuel and electrical supplies are turned off as the main fan(s) can start, at any time whilst the electricity is turned on, under the control of the combination fan/limit thermostat.

***NOTE 1***: After any maintenance work always test fire the heater in the prescribe manner to make sure all safety systems are in working order before leaving the heater to run normally.

***NOTE 2***: Check all pipe joints with the burner running. Any leaks must be repaired before leaving the heater to fire normally.

***NOTE 3***: After routine maintenance, the commissioning procedure, Section 5 must be carried out to ensure that peak efficiency and safety is maintained.

After commissioning the heater will require very little maintenance.

It is recommended one service a year is carried out to the procedures detailed below, except in dirty or dusty environments where servicing may be required more frequently.

Minor faults may be traced by use of the Fault Finding charts in Section 9.

A list of parts that may be needed during maintenance is given in Section 11.

## 7.1 Burner Maintenance

See the Manufacturers Information for specific instructions.

The maintenance of the burner should include cleaning of the fan (and fuel filters when fitted), inspection of all components including the flame monitoring and ignition system and correct operation of fuel control valves.

For oil fired burners it is recommended that the atomising oil nozzle is replaced during the annual service with one of the correct make, size and type.

## 7.2 Main Fan

The main fan requires very little maintenance as the bearings are sealed for life and need no lubrication. If fan blades need cleaning remove the heater side panels and use a small brush or duster to clean the blades from each side of the fan(s).

On belt drive fans, check belt condition. This is best carried out with belts removed, and examine for lateral cracks or chaffing, replace if necessary. Double belts should be replaced together as a pair.

Check belt tension see Fig. 7.1. Do not over-tighten belts as this may cause bearing damage.

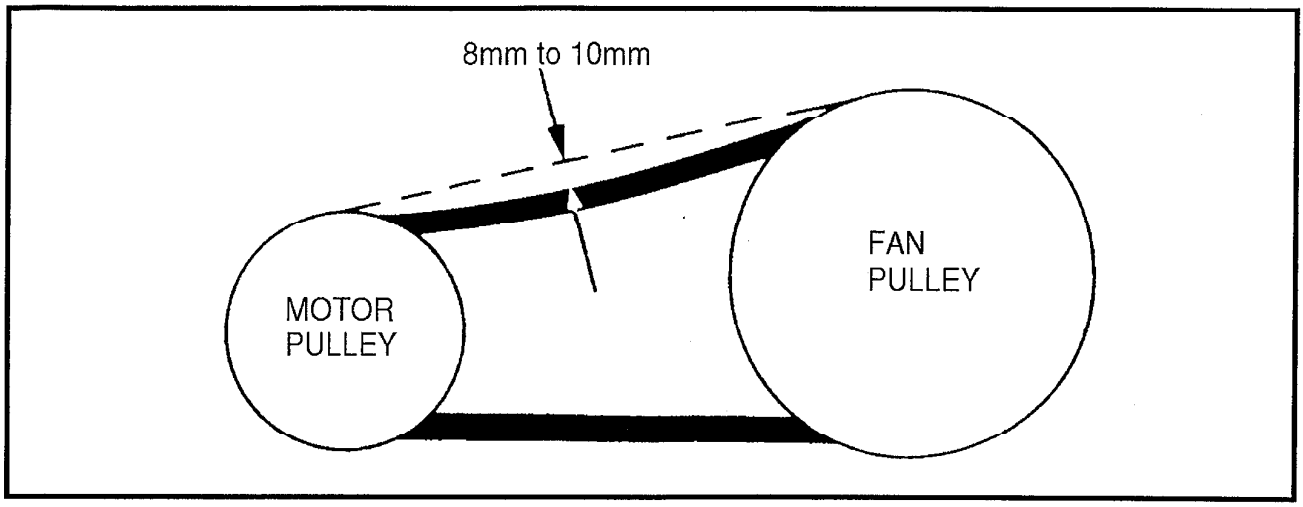



**Fig. 7.1 Fan Belt Tension**

## 7.3 Heat Exchanger Maintenance

1. Remove burner by following Section 8.1.
2. Remove upper front panel.
3. Remove nuts, bolts and washers to remove front cover of heat exchanger. Remove and inspect the heat exchanger turbulators (one for each tube). Clean out any deposits from flue ways and combustion chamber, ideally using a vacuum cleaner and brush. Visually inspect the combustion chamber and heat exchanger for damage or corrosion, any damage must be referred to Roberts-Gordon UK Ltd. for advice.
4. Replace components in reverse order to above - replacing gasket material and any damaged turbulators, bolts and nuts if necessary.
5. Inspect and repair any damage to the seal between the flue and the heater flue spigot.

## 7.4 Thermal Insulation

Whilst the upper panels are removed for heat exchanger servicing the thermal insulation fitted to all the upper panels must be inspected. This should be sound with the foil face in good condition. If any thermal insulation is in poor condition then it must be replaced with new insulation material and suitably sealed at the edges with adhesive foil tape to prevent the fibres from being distributed by the heated air.

# *Section 8.* Removal & Replacement of Parts

**See Warnings at start of Section 7 before removal and replacement of parts.**

## 8.1 The Burner and it's Components

**To remove the burner from the heater:**
Unplug the burner electrical supply from the heater.
Isolate the fuel supply at the inlet manual valve and disconnect the inlet fuel pipe.
Unscrew the nuts securing the burner mounting flange to the front of the heater.
Pull off the burner from the heater, retaining the gasket for reuse.

For removal of burner components, follow instructions in the Manufacturer's Information.

To refit the burner reverse the above, being careful to fit the gasket between the burner mounting flange and the heater. Use a new one if necessary.

## 8.2 Direct On Line Main Fan Starter & Thermal Overload Unit (Three Phase Models Only)

This assembly comprises two parts, 'A' the Contactor, and 'B' the Overloads (see Fig. 2.4), which may be changed separately.

**'A' - The Contactor:** this is fixed by two diagonally opposite screws.

**To remove:** first remove the overloads as above, then remove the line connections to the top of the contactor (noting the colour code) and the two coil connections at the top rear of the contactor.

Unscrew the fixing screws to remove the contactor from the panel.

**To refit:** reverse the above operations. Check rotation of fan following work on the contactor.

**'B' - The Overloads:** these are fixed only by the 3 load connections at the lower end of the contactor and are fitted to Models 60 to 100 only.

**To remove:** unscrew the motor connecting wires from their terminals at the bottom of the assembly - Note the colour code.

Disconnect the overload circuit connections near the overload reset button.

Disconnect the overload fixing and connecting screws at the bottom of the contactor.

Ensure that any replacement overload is of the correct rating and that it is reset as in 2.5.

## 8.3 Control Circuit Fuse (10 or 5 amp 1 ¼" long sand filled)

The control circuit fuse is removed by grasping firmly in the centre and pulling out of the spring clips.

**To replace:** push a new fuse into the spring clips.

To replace the holder, first remove the fuse, pull off the two tag connectors from either end and then unscrew the central fixing screw.

**To refit:** reverse the above procedure, noting the locating peg on the rear of the holder, engages in the hole provided.

## 8.4 Combination Fan/Limit Thermostat (See Fig. 1.1)

To gain access to this thermostat, slacken the cover retaining screw (on top) and pull off the cover.

Disconnect the electrical connections by pushing in with a small screwdriver and pulling out the wiring (see Fig. 2.3).

Unscrew the conduit bush and the two fixing screws and withdraw the unit from the cabinet.

**To refit:** reverse the above procedure and reset as in 5.1.2.1.

Set the new thermostat as described in Section 5 and seal the setting of the limit hand.

**WARNING**
**WHEN REPLACING A COMBINATION THERMOSTAT ENSURE THAT THE LOW VOLTAGE LINK MARKED ON THE THERMOSTAT 'REMOVE FOR LOW VOLTAGE' IS REMOVED (SEE FIG. 2.3).**
**PERMANENT DAMAGE WILL BE CAUSED BY LEAVING THIS LINK IN.**

## 8.5 Main Fan Motor (Three Phase Belt Drive Heaters Only)

Disconnect electrical connections at contactor/overloads (see Fig. 2.4 and Section 8.2).
For Starr/Delta starters there are 6 wires between the motor and the starter.

Remove the left-hand lower side panel to gain access to the motor.

Unscrew the bolts securing the motor to the mounting bracket. The motor will now lift out.

**To refit:** reverse the above procedure, tensioning the belts as in 7.2 and ensuring that the pulleys are properly aligned i.e. the belts should be exactly parallel to the fan case.

For Star/Delta starters, play specific attention to the 6 motor connections. They must be as shown in Fig. 6.14, otherwise motor damage may occur.

## 8.6 Main Fan Units

Dependent on the model of the heater the main fan unit will be direct drive (with integral motor) or belt drive. The belt drive units are normally the double fan units (i.e. two fan on a single shaft) that are used on the models 060 to 0100.

All the fans are secured to the base of the heater by four bolts per fan case, and also to the fan tray by bolts through the outlet flange.

To gain access to the fans remove the lower side panels of the heater. For models 060 and above or High Flow models, remove the upper side panels of the same side and the vertical centre bar to allow the fans to slide out of the cabinet.

Disconnect the electrical connections, on direct drive units these will be at the terminal block for single phase and the contactor for three phase.

Remove the fixings securing the fan, and the fan will now pull out of the heater through the side.

To refit reverse the above ensuring correct belt alignment and tension as in 8.6 for belt drive units.

Check the correct rotation of the fan under power see 5.1.1.4.

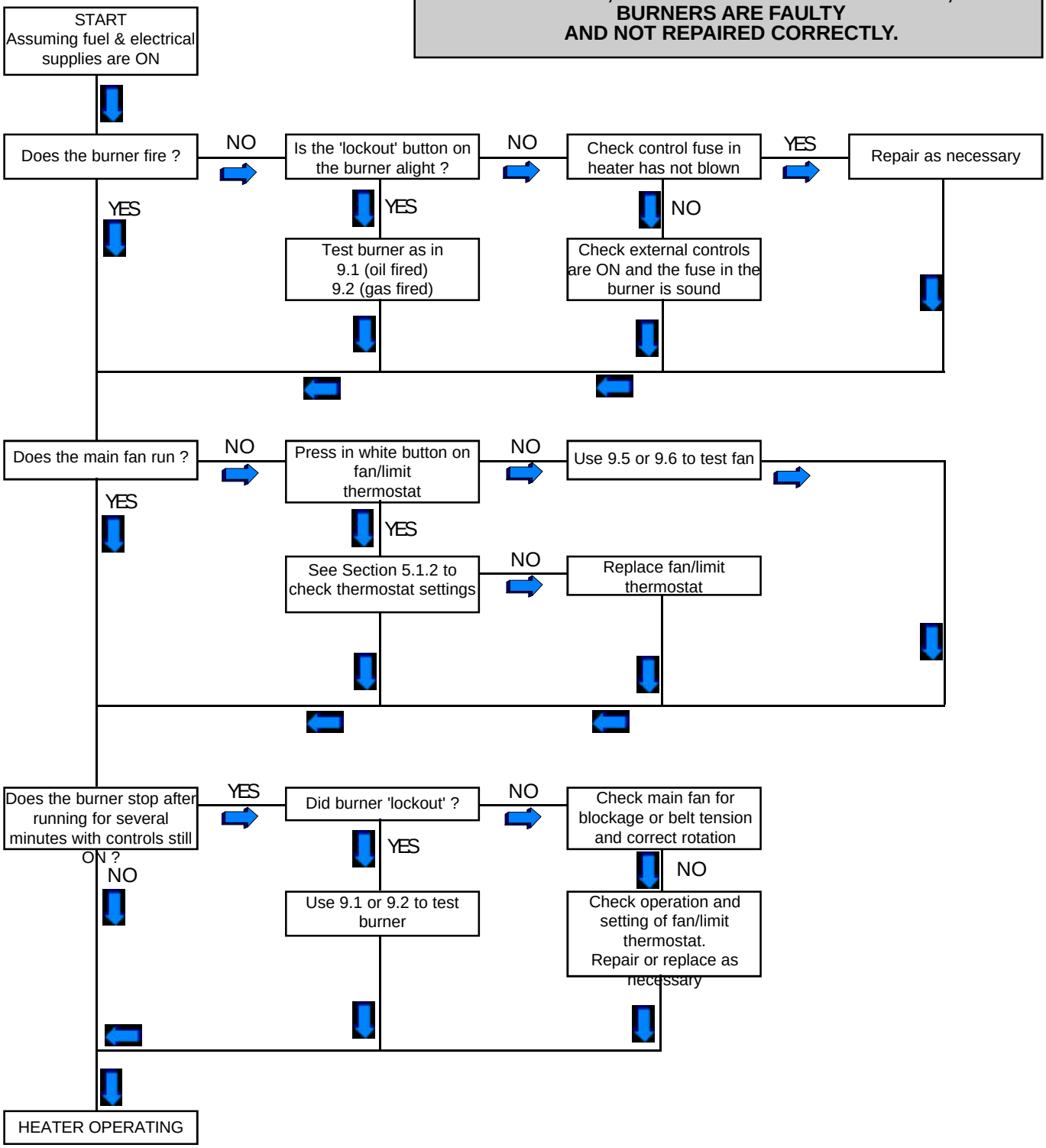
***Note:*** The motor on Direct Drive Fan Units can only be replaced as a complete fan/motor assembly to ensure that they are correctly balanced.

Always test fire the heaters as in 'Commissioning of the Air Heater' Section 5.

# *Section 9.* Fault Finding Charts

## General - All heaters

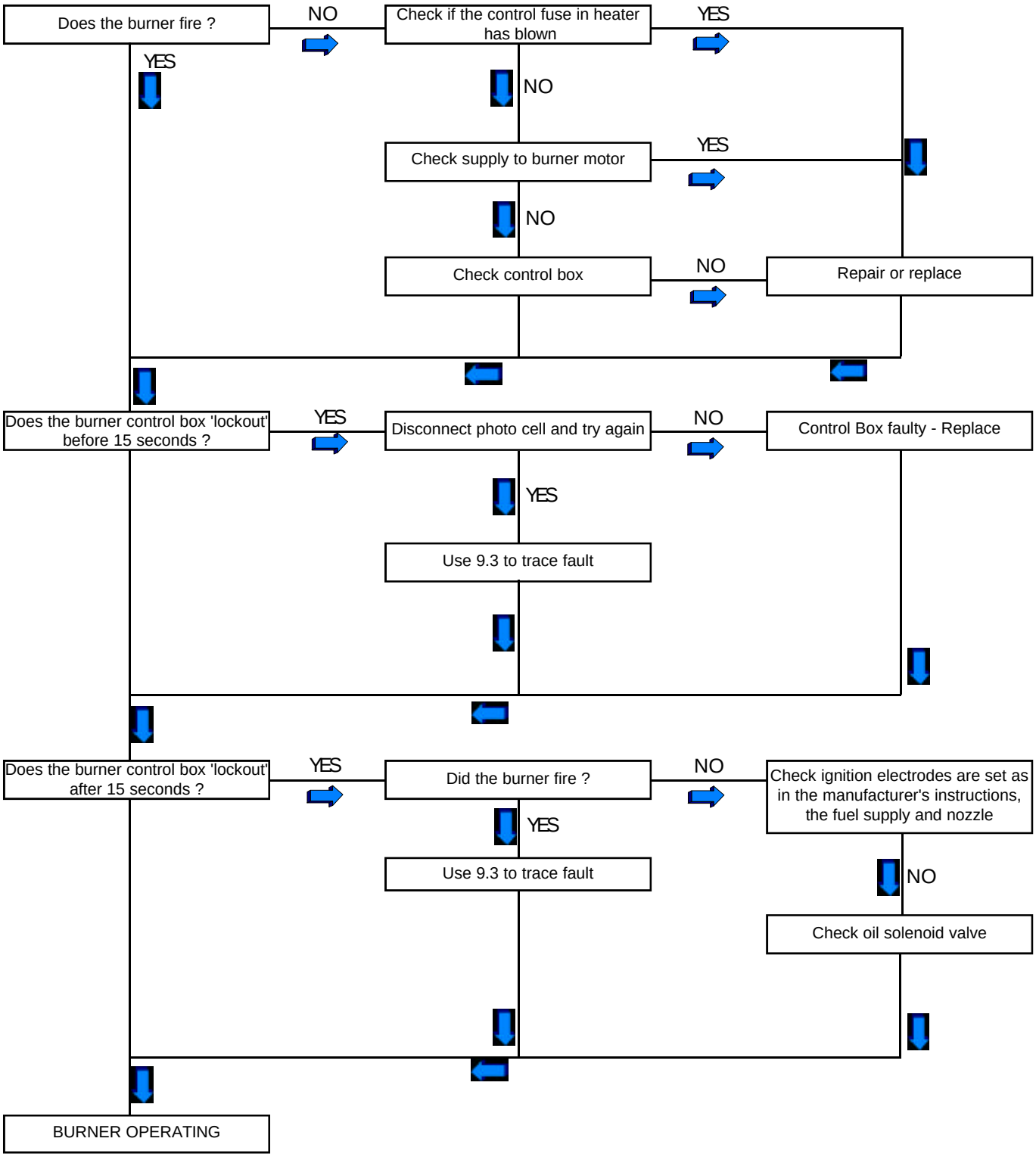
**WARNING**
**FAULT FINDING SHOULD ONLY BE CARRIED OUT BY EXPERIENCED ENGINEERS WHO FULLY UNDERSTAND THE OPERATION OF THE BURNERS.**
**GAS HEATERS MAY ONLY BE REPAIRED BY A C.O.R.G.I. REGISTERED ENGINEER.**
**THERE IS A RISK, INCLUDING THAT OF EXPLOSION, WHEN BURNERS ARE FAULTY AND NOT REPAIRED CORRECTLY.**


START
Assuming fuel & electrical supplies are ON
Does the burner fire ?
NO
Is the 'lockout' button on the burner alight ?
NO
Check control fuse in heater has not blown
YES
Repair as necessary
YES
YES
Test burner as in 9.1 (oil fired) 9.2 (gas fired)
NO
Check external controls are ON and the fuse in the burner is sound
Does the main fan run ?
NO
Press in white button on fan/limit thermostat
NO
Use 9.5 or 9.6 to test fan
YES
YES
See Section 5.1.2 to check thermostat settings
NO
Replace fan/limit thermostat
Does the burner stop after running for several minutes with controls still ON ?
YES
Did burner 'lockout' ?
NO
Check main fan for blockage or belt tension and correct rotation
NO
YES
Use 9.1 or 9.2 to test burner
NO
Check operation and setting of fan/limit thermostat. Repair or replace as necessary
HEATER OPERATING

Following the replacement or adjustment of parts carry out the commissioning procedure as specified in Section 5 and the burner manufacturer's instructions.

## 9.1 Oil Burner Fault Finding (See Burner Manufacturer's Instructions)

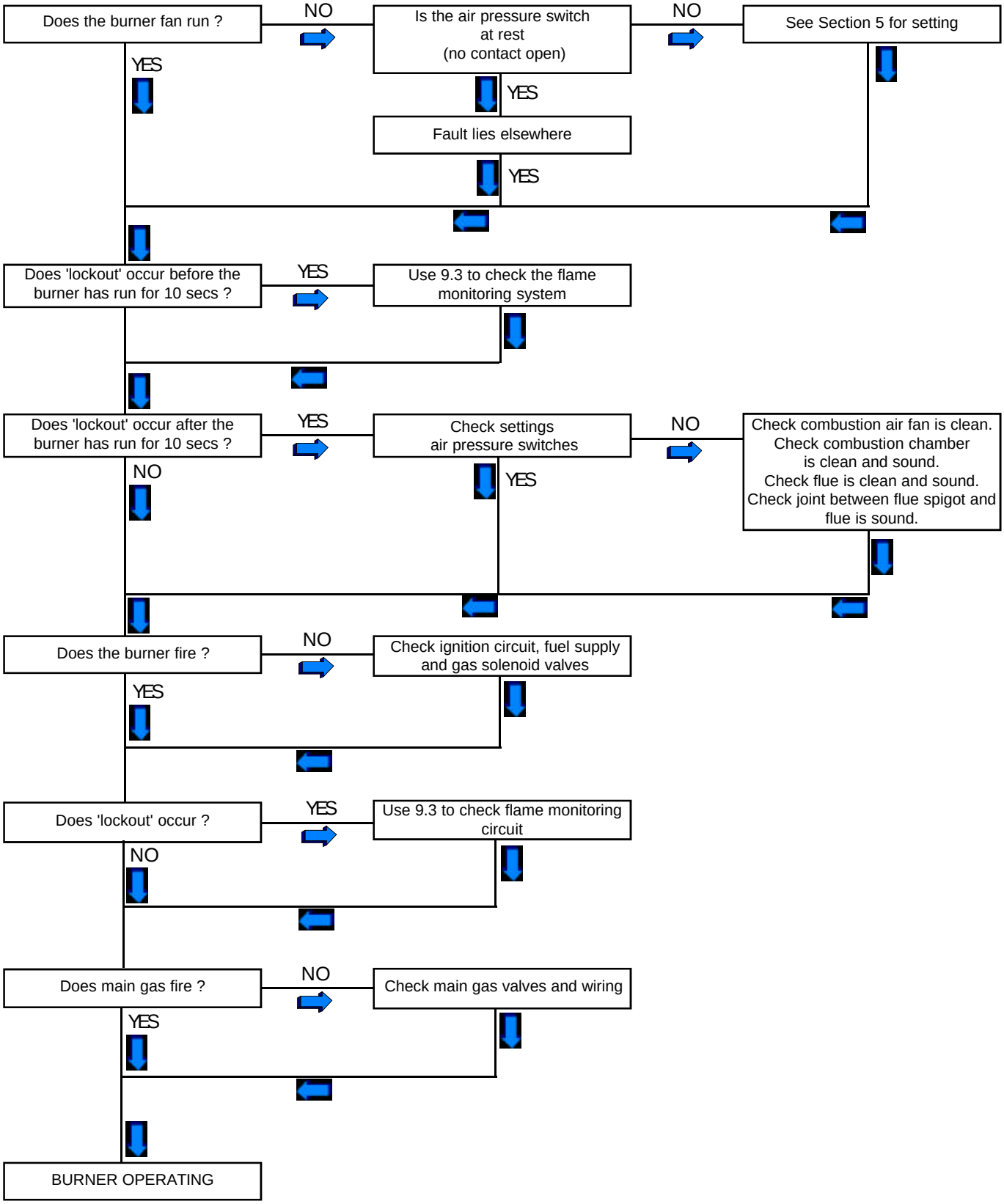
Start assuming that there is a proven fuel and electricity supply to the burner i.e. all external controls are on.



## 9.2 Gas Burner Fault Finding (see also Burner Manufacturer's Instructions)

**Gas heaters may only be repaired by a C.O.R.G.I. registered engineer.**

Start by assuming that there is a proven fuel and electricity supply to the burner i.e. all external controls are on.

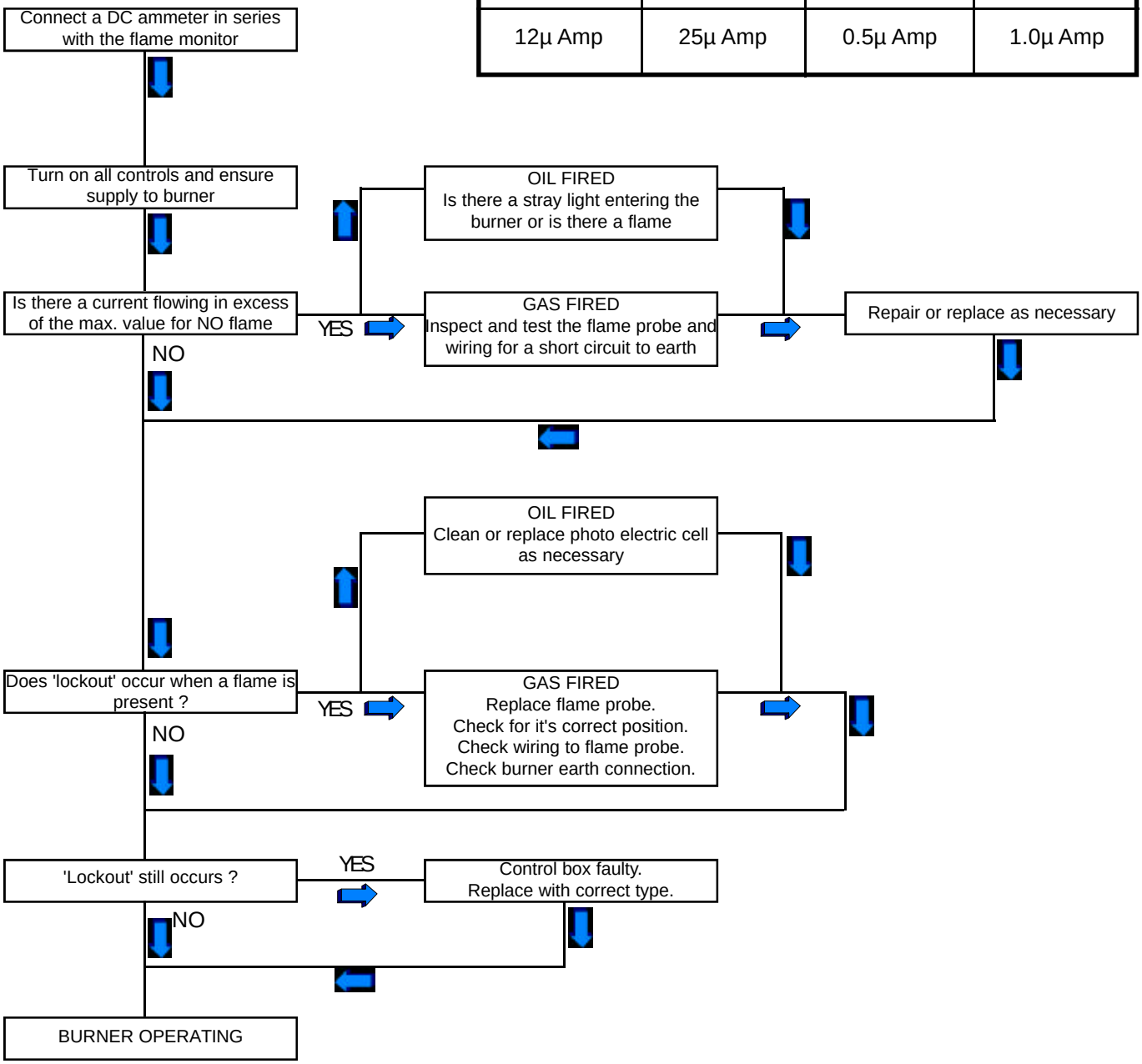

Does the burner fan run ?
NO
Is the air pressure switch at rest (no contact open)
NO
See Section 5 for setting
YES
YES
Fault lies elsewhere
YES
Does 'lockout' occur before the burner has run for 10 secs ?
YES
Use 9.3 to check the flame monitoring system
Does 'lockout' occur after the burner has run for 10 secs ?
YES
Check settings air pressure switches
NO
Check combustion air fan is clean. Check combustion chamber is clean and sound. Check flue is clean and sound. Check joint between flue spigot and flue is sound.
NO
YES
Does the burner fire ?
NO
Check ignition circuit, fuel supply and gas solenoid valves
YES
Does 'lockout' occur ?
YES
Use 9.3 to check flame monitoring circuit
NO
Does main gas fire ?
NO
Check main gas valves and wiring
YES
BURNER OPERATING

## 9.3 Flame Supervision Systems

The flame supervision system used for gas fired and oil fired heaters is different but may be tested in a similar way.
Gas fired heaters use a rectification flame probe to monitor the flame.
Oil fired heaters use a photo sensitive cell to monitor the flame.
To connect a suitable meter into the circuit to monitor the flame signal current, disconnect one of the wires to the monitor (there is only one for gas fired).
Connect a suitable DC ammeter between the terminal just disconnected and the wire taken from it. Should the meter read backwards, then reverse its connections.

Readings should be approximately as follows:- For further details see Burner Manufacturer's instructions

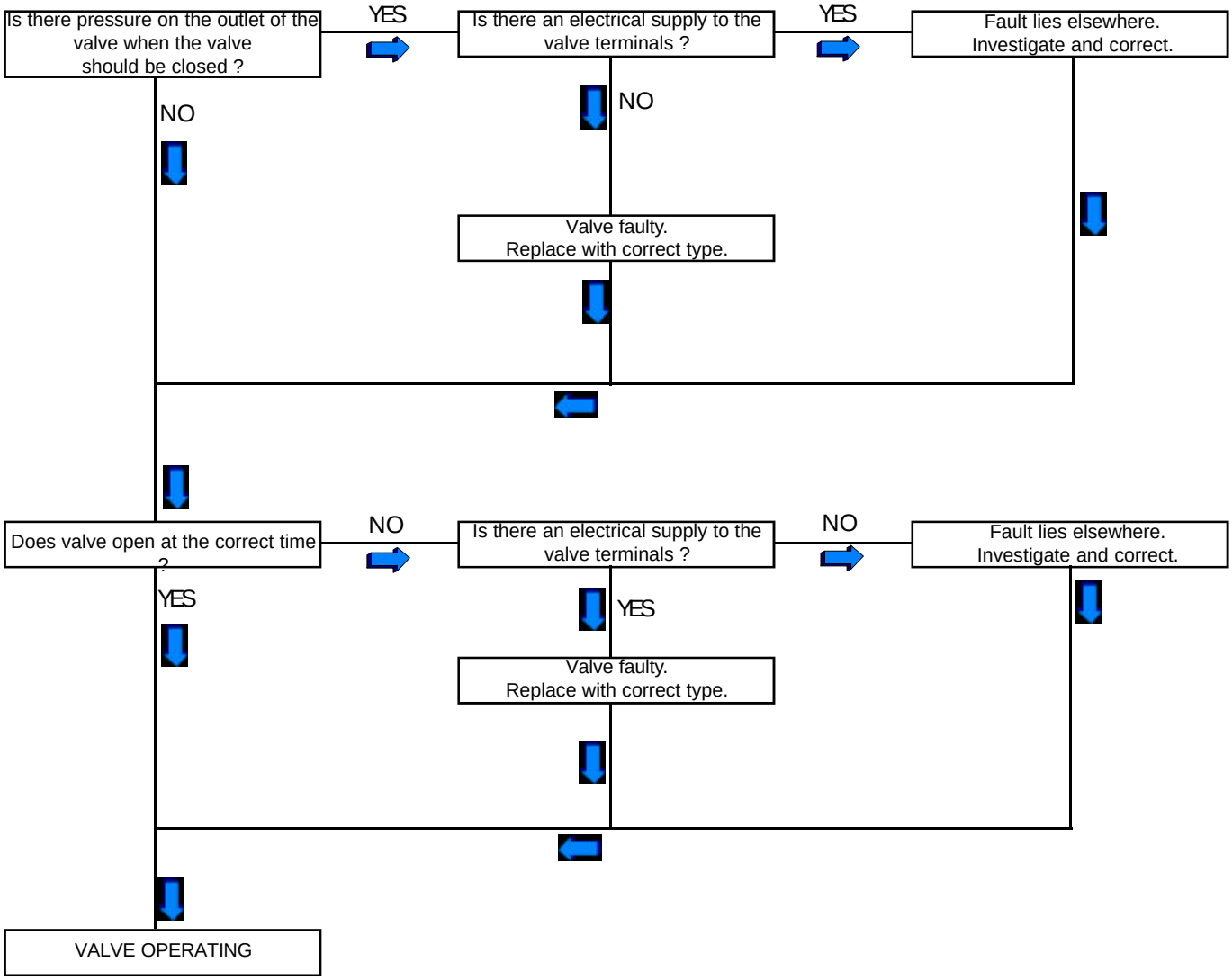
| Oil Fired | | Gas Fired | |
|---|---|---|---|
| Maximum flame current with no flame | Minimum flame current with flame | Maximum flame current with no flame | Minimum flame current with flame |
| 12µ Amp | 25µ Amp | 0.5µ Amp | 1.0µ Amp |


Connect a DC ammeter in series with the flame monitor
Turn on all controls and ensure supply to burner
Is there a current flowing in excess of the max. value for NO flame
YES
OIL FIRED
Is there a stray light entering the burner or is there a flame
GAS FIRED
Inspect and test the flame probe and wiring for a short circuit to earth
Repair or replace as necessary
NO
OIL FIRED
Clean or replace photo electric cell as necessary
Does 'lockout' occur when a flame is present ?
YES
GAS FIRED
Replace flame probe.
Check for it's correct position.
Check wiring to flame probe.
Check burner earth connection.
NO
'Lockout' still occurs ?
YES
Control box faulty.
Replace with correct type.
NO
BURNER OPERATING

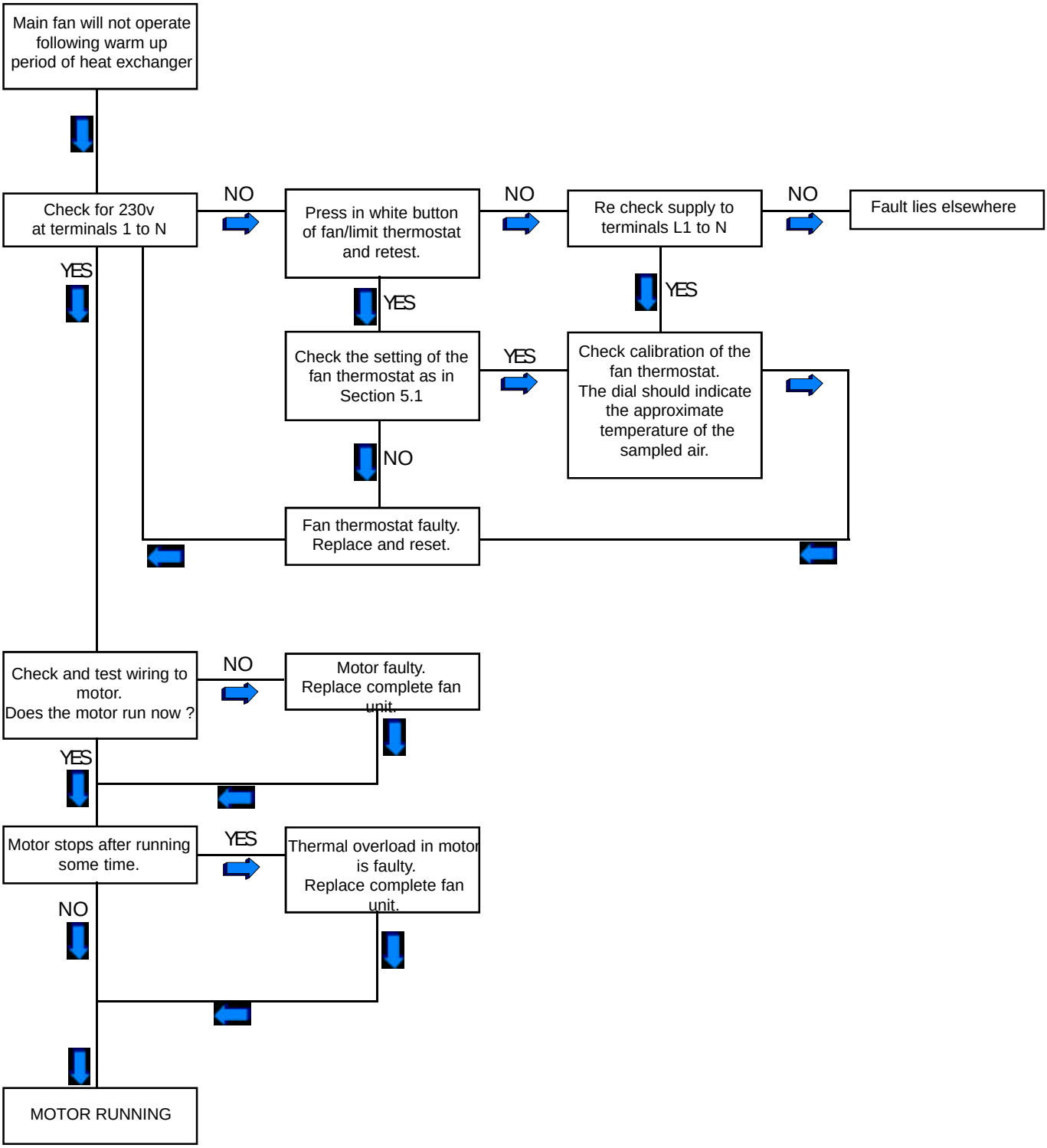
## 9.4 Solenoid Valve Circuit

To test the operation of a solenoid valve requires the checking of both the electrical and the mechanical operations.

To test the mechanical operation of the valve requires a suitable pressure gauge to be fitted to the outlet of the valve and the rise in pressure observed at the appropriate time.

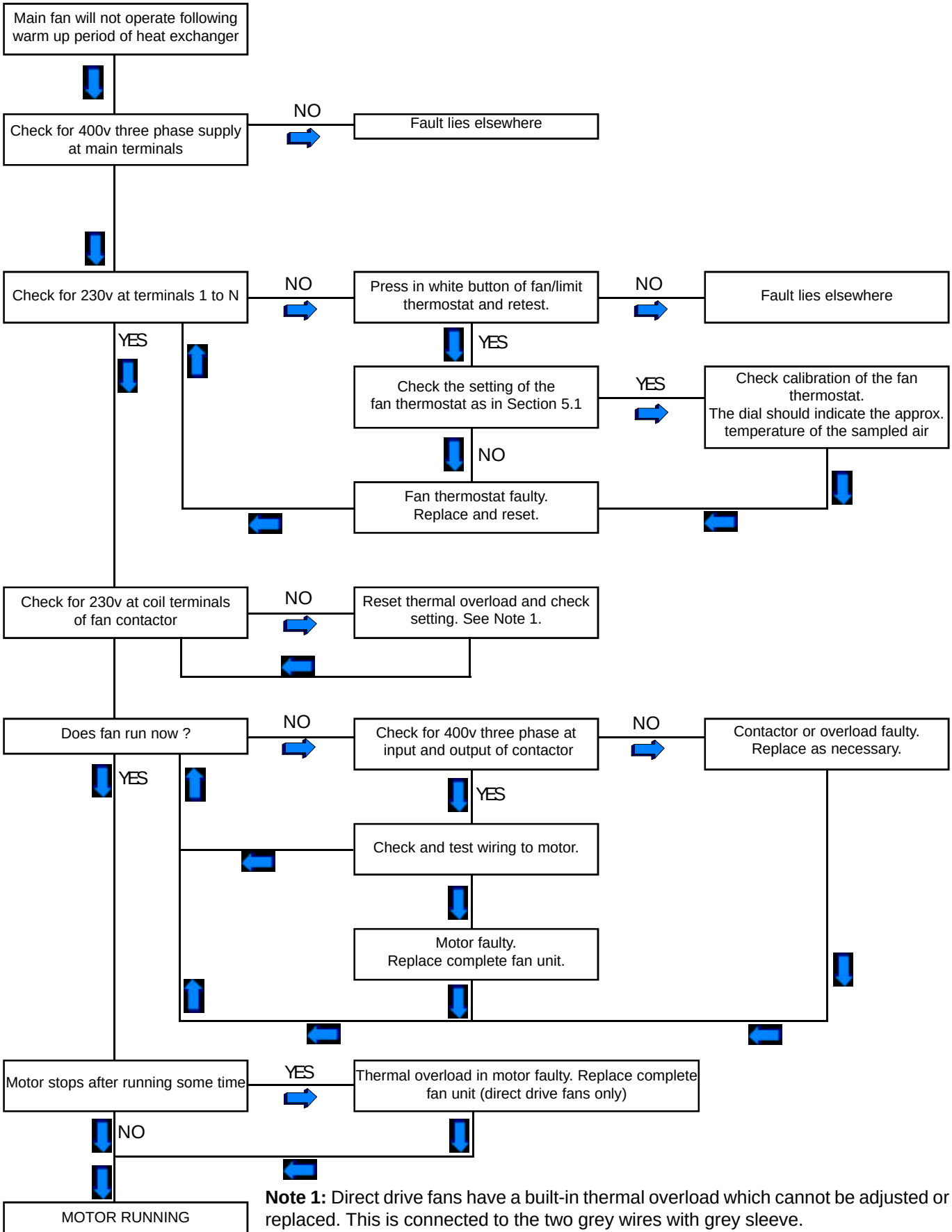

Is there pressure on the outlet of the valve when the valve should be closed ?
YES
Is there an electrical supply to the valve terminals ?
YES
Fault lies elsewhere. Investigate and correct.
NO
NO
Valve faulty. Replace with correct type.
Does valve open at the correct time ?
NO
Is there an electrical supply to the valve terminals ?
NO
Fault lies elsewhere. Investigate and correct.
YES
YES
Valve faulty. Replace with correct type.
VALVE OPERATING

## 9.5 Main Fan Circuit (Single Phase)


Main fan will not operate following warm up period of heat exchanger
Check for 230v at terminals 1 to N
NO
Press in white button of fan/limit thermostat and retest.
NO
Re check supply to terminals L1 to N
NO
Fault lies elsewhere
YES
YES
YES
Check the setting of the fan thermostat as in Section 5.1
YES
Check calibration of the fan thermostat. The dial should indicate the approximate temperature of the sampled air.
NO
Fan thermostat faulty. Replace and reset.
Check and test wiring to motor. Does the motor run now ?
NO
Motor faulty. Replace complete fan unit.
YES
Motor stops after running some time.
YES
Thermal overload in motor is faulty. Replace complete fan unit.
NO
MOTOR RUNNING

***Note:*** Direct drive fans are normally changed as a complete assembly to ensure correct fan balancing.

## 9.6 Main Fan Circuit (Three Phase)


Main fan will not operate following warm up period of heat exchanger
Check for 400v three phase supply at main terminals
NO
Fault lies elsewhere
Check for 230v at terminals 1 to N
NO
Press in white button of fan/limit thermostat and retest.
NO
Fault lies elsewhere
YES
YES
Check the setting of the fan thermostat as in Section 5.1
YES
Check calibration of the fan thermostat. The dial should indicate the approx. temperature of the sampled air
NO
Fan thermostat faulty. Replace and reset.
Check for 230v at coil terminals of fan contactor
NO
Reset thermal overload and check setting. See Note 1.
Does fan run now ?
NO
Check for 400v three phase at input and output of contactor
NO
Contactor or overload faulty. Replace as necessary.
YES
YES
Check and test wiring to motor.
Motor faulty. Replace complete fan unit.
Motor stops after running some time
YES
Thermal overload in motor faulty. Replace complete fan unit (direct drive fans only)
NO
MOTOR RUNNING

**Note 1:** Direct drive fans have a built-in thermal overload which cannot be adjusted or replaced. This is connected to the two grey wires with grey sleeve.
**Note 2:** Direct drive fans are normally changed as a complete assembly to ensure correct fan balancing.

# *Section 10.* User Instructions

The normal user controls are installed remote from the heater and will consist of, at minimum, a room thermostat. Where a Roberts-Gordon control unit is used the operation of the heater will be fully automatic from this control as described in the instructions supplied with the control.

The only user controls situated on the heater are:

| | |
|---|---|
| The fan run button | see 10.2.2 |
| The limit thermostat reset | see 10.2.2 |
| The burner lockout reset button | see 10.2.1 |

## 10.1 Heater Operation (On/Off Operation)

When the heater has been switched on (see Section 10.3) and the remote thermostat and/or time switch calls for heat, the automatic control box turns on the burner and constantly monitors its safe operation (see Section 2.2).

When the heat exchanger is sufficiently heated, the fan thermostat turns on the main fan(s) and warm air is discharged from the top of the heater.

***Note:*** on horizontally mounted heaters, High Flow heaters and models with High/Low or Modulating burners and some fully ducted heaters the fan will come on during the burner firing cycle and not wait for the temperature rise. This is to ensure that there is always a proper operation of the heater under all possible conditions.

When the environmental working temperature, as set on the remote thermostat is achieved, the burner shuts off. The main fan runs until all the heat has been extracted from the heat exchanger and the fan thermostat detects a drop in leaving air temperature sufficient to turn it off. The heater then is at rest until the beginning of the next cycle.

### 10.1.1 Heater operation (for High/Low or Modulating)

The heater will operate as described above but with the added features as below

**High /Low operation**
A second thermostat or two stage thermostat will be installed on site so that as the temperature reaches the first set point the firing rate will reduce to low fire . This gives a closer temperature control on controlled temperature and also reduces the temperature of the air leaving the heater.
Should the temperature continue to rise to the second set point then the burner will turn off.
When the burner comes on again it may start at either the high fire or low fire rate dependant upon the temperature adjacent to the temperature control.

To set the operating temperature of a two stage thermostat simply operate the contro to indicate the required temperature. If two separate control thermostats are used then great care is required to ensure that the operation of the two thermostats does not overlap. It is recommended that two stage controls are used to prevent this occuring.

**Fully Modulating Operation**
The on site control for these burners is a temperature controller that provides a varying output signal dependant upon the ambient temperature to the control. The burner firing rate will continuously vary in sympathy with this output between the maximum and minimum settings as set during commissioning. If the temperature continues to rise even though the firing rate is at minimum then the burner will close down as in 10.1.
To set the operating temperature follow the instruction provided with the control.

### 10.2.1 Burner Lockout Reset Button

This button which is built into the burner control box will illuminate when the control has gone to safety shut down 'lockout'.

This may be caused by flame failure.

After lockout has occurred, a waiting time of one minute must be observed before an attempt to reset the control is made by pressing in the illuminated button.

WARNING
IF THE CONTROL SHOULD GO TO 'LOCKOUT' AGAIN, DO NOT MAKE FURTHER ATTEMPTS AT RESTARTING THE HEATER UNTIL THE FAULT HAS BEEN TRACED AND REPAIRED BY A COMPETENT PERSON.

FOR OIL FIRED HEATERS IT SHOULD BE NOTED THAT UNBURNED RESIDUAL OIL IN THE COMBUSTION CHAMBER IS AN EXPLOSION RISK.

### 10.2.2 Combination Fan/Limit Thermostat

This is located on the top right hand side of the heater, see Fig. 1.1. This control ensures the heater does not blow cold air in the normal heating cycle and protects the heat exchanger against overheating.

Although it should not be necessary for the user to touch this control, it is worth noting that:

Pressing in the white button on the combination fan limit thermostat causes the main fan(s) to run continuously.

For normal operation this button should be pulled to the out position.

If for any reason the main fan should fail or the air flow is reduced the built in limit thermostat will cause the burner to go to safety shut down 'lockout'. This condition will persist until the fault is corrected and the manual reset button is operated. The combination fan/limit thermostat is located on the right-hand side of the heater and is preset during commissioning (see 5.1.2.1).

The limit thermostat is a manual reset device. To reset press in and release the red reset button after allowing the heater to cool.

**WARNING**
**THE MAIN ELECTRICAL ISOLATOR SHOULD ONLY BE USED IN AN EMERGENCY AND SHOULD NOT BE USED FOR CLOSING DOWN THE BURNER, AS THIS SWITCHES OFF THE MAIN FAN PREMATURELY AND MAY DAMAGE THE HEAT EXCHANGER, INVALIDATING THE WARRANTY AND CAUSING A POTENTIAL FIRE HAZARD.**

## 10.3 Lighting Instructions (All Heaters)

### 10.3.1 To Turn the Heater On

**a**. Ensure the fuel supply to the heater is on, that all remote controls are set to ON .

***Note:*** The setting of the remote thermostat must be above ambient for the heater to operate.

**b**. Switch on the electrical supply at the isolator .

**Note:** After long shut down periods the Control Box may go to lockout due to air in the burner head. Hence it may be necessary to press the lockout reset button two or three times before a start is made. After lockout always wait one minute before pressing the lockout reset button.

**WARNING**
**IF THE HEATER DOES NOT OPERATE AFTER THE THIRD DEPRESSION OF THE LOCKOUT RESET, DO NOT MAKE ANY FURTHER START ATTEMPTS UNTIL THE FAULT HAS BEEN TRACED AND CORRECTED BY A COMPETENT ENGINEER.**

**FOR OIL FIRED HEATERS, UNBURNED RESIDUAL OIL IN THE COMBUSTION CHAMBER IS AN EXPLOSION RISK.**

### 10.3.2 To Turn the Heater Off

### 10.3.2.1 (Short Periods)

**a**. Turn Off the remote controls fitted on site or turn down the setting of the remote thermostat so that it is below ambient temperature. .

**b**. To restart, move the control used above to its normal position.

### 10.3.2.2 (Long Periods)

**a**. Carry out the operation of 10.3.2.1 above.

**b**. When the main fan(s) have stopped automatically, turn off the fuel supply valve.

**c**. Turn off the main electrical isolator.

### 10.3.3 To Restart After Long Shut Off Period

**a**. Open the fuel supply valve.

**b**. Carry out operation from 10.3.1.

### 10.4.1 Simple Fault Finding (All Heater Types)

If the heater does not operate when the external controls are ON , then check that.....

**a**. Electrical supply is switched on.

**b**. The remote thermostat is calling for heat.

**c**. The remote time switch (if Fitted) is in an ‘ON’ period.

**d**. The burner has not gone to "Lockout"

**e**. The Limit thermostat has not operated.

**f**. The burner supply plug has not been removed.

**g**. If the main fan runs continuously, has the white button on the Fan/Limit thermostat been pressed in? (See 10.2.2) or is any remote fan switch in the ON position.

### 10.4.2 Simple Fault finding (Oil Fired Heaters)

**a**. The appliance fuel valve is open and there is adequate oil in the tank.

***Note:*** If the fuel tank and/or fuel lines have run dry, then the fuel system will need to have the air vented from it before the heater will fire. To vent the air from the fuel pipes, slacken the vent screw on top of the inlet filter. Wait until the oil comes through this vent before resealing. This may take some time as often pockets of air can follow oil until all of the air is removed.

The air will also need to be vented from the burner pump. To carry out pump venting, the pump must be running (see burner manufacturer's instructions). Slacken the pump vent port and turn on the burner.

If the burner goes to ‘lockout’ before the pump has vented, reset the control box, and repeat until all the air has been vented from the pump and the burner fires.

**Note:** Wait one minute before attempting to reset the control box.

**WARNING**
**If the heater does not operate after the third depression of the lockout reset, do not make any further start attempts until the fault has been traced and corrected by a competent engineer.**

**For oil fired heaters, unburned residual oil in the combustion chamber is an explosion risk.**

If a BM Oil Lifter is used on the installation, this will need priming after running empty. See manufacturer’s leaflet supplied with the unit.

### 10.4.3 Simple Fault Finding (Gas Fired Heaters)

**a**. Is the gas manual valve turned on.

**b**. Has the flue to the heater become damaged.

## 10.5 Service Information

After commissioning, your COMBAT® warm air heater will need very little attention.

It is recommended that a service is carried out at least once per year to ensure continued safe and efficient operation except that in dirty or dusty environments more frequent servicing may be necessary.

***Note:*** Gas fired heaters may only be serviced by a C.O.R.G.I. registered engineer.

For further Service details, please contact the Roberts-Gordon Service Department on 01902 498733.

### 10.5.1 Care Of Heater

It is important for the safe operation of the heater that rubbish or other materials are not allowed to accumulate around the air intake grilles of the heater. A clear area of at least 0.6 metres at the sides and rear of the heater and 2 metres at the front of the heater should be maintained at all times and the air intake grilles must not be covered or blocked by debris.

**IMPORTANT**
For maintenance of the heater all of the upper panels need to be removed for the checking and replacement of insulation. Also the lower side panels are the only access for removal of the main fan, it is therefore necessary to have a minimum clear area of at least 1 m to one of the sides for this purpose.

There should be a clear distance of at least 4 m from the discharge heads to ensure free flow of warm air.

The heater casing may be cleaned by wiping with a cloth dampened with soapy water. Do not use abrasive materials or excessive water.

**WARNING**

IF AT ANY TIME A GAS LEAK IS SUSPECTED TURN OFF THE GAS SUPPLY.

DO NOT use a naked light.

DO NOT operate electrical switches or controls.

Contact your local Gas supply undertaking immediately.

# *Section 11.* Conversion Information

All COMBAT® cabinet heaters may be operated on fuel oil, natural gas or propane gas, dependant upon which burner type has been fitted.

Any conversion of an existing heater to burn a different fuel will need to be carried out by suitably qualified engineers in accordance with the information available from Roberts-Gordon UK Ltd. and the burner manufacturer.

Conversion of a gas heater to burn a different fuel must only be carried out strictly to the information provided so as to maintain compliance with the conditions of the C.E. product certification.

Burners designed to operate on class D (35 sec) fuel oil (also known as Gas Oil) may be converted to operate on 28 sec kerosine with the understanding that this may shorten the life expectancy of the fuel pump and some other fuel carrying components.

For details of the changes necessary please contact Roberts-Gordon UK Ltd. quoting the heater serial number and burner type fitted.

Burners designed to burn natural gas may be converted to burn L.P.G Propane gas. For details of the changes necessary please contact Roberts-Gordon UK Ltd. quoting the heater serial number and burner type fitted or consult the burner manufacturers information.

Burners designed to burn L.P.G. Propane gas may be converted to burn Natural gas. For details of the changes necessary please contact Roberts-Gordon UK Ltd. quoting the heater serial number and burner type fitted or consult the burner manufacturers information.

Heaters designed to burn fuel oil may only be converted to burn gas by replacement of the complete burner.

Heaters designed to operate on gas may only be converted to burn fuel oil by replacement of the complete burner.

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# *Section 12.* Parts List

The following items are recommended as spares which may be required during routine service and replacement of the air heater.

There is also a list of parts in the burner manufacturer's manual which relates to the parts required for the packaged burner fitted to the heater.

| Part Number | Description | Heater Model | No. Fitted |
|---|---|---|---|
| A 025 | DDC 1220 direct drive fan | 015 to 030 | 1 |
| A 029 | DDC 1500 direct drive fan | 040 to 050 | 1 |
| A 038 | BDC 1500 belt drive fan | 060 to 0100 | 1 |
| A 136 | A49 vee belt | 060 to 0100 | 2 |
| K 017 | Combination fan\limit stat | All Models | 1 |
| D 004A | Motor Contactor | 040 to 0100 | 1 |
| D 020A | Motor overload 4.5/7.5 amp | 060 to 070 | 1 |
| D 024A | Motor overload 6-10 amp | 0100 | 1 |

## Roberts-Gordon Contact Numbers

**Spares:** Tel: 01902 499051 Fax: 01902 492411

**Service Dept:** Tel: 01902 498733 Fax: 01902 401464

**All Other Departments:** Tel: 01902 494425 Fax: 01902 403200

# GAS HEATER COMMISSIONING DATA SHEET

DATE MODEL NUMBER SERIAL No T No

C02% CO PPM .....FLUE DRAUGHT

GROSS STACK TEMP °C .....

BURNER TYPE .....

BURNER HEAD SETTING.....

PRESSURE LOSS ACROSS SECOND MAIN VALVE .....

START GAS PRESSURE MAIN GAS PRESSURE

INLET PRESSURE MEASURE GAS FLOW

COMMENTS:

# OIL HEATER COMMISSIONING DATA SHEET

DATE MODEL NUMBER SERIAL No T No

C02% .... SMOKE NUMBER FLUE DRAUGHT

GROSS STACK TEMP °C .....

BURNER TYPE .....

BURNER HEAD SETTING

NOZZLE SIZE AND .

BURNER PRESSURE .....

COMMENTS

ROBERTS GORDON

# CONTACTS

SERVICE
Tel: 01902 498733
Fax: 01902 401464

SPARES
Tel: 01902 499051
Fax: 01902 492411

MAIN SWITCHBOARD
Tel: 01902 494425
Fax: 01902 403200

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